PES Environmental, Inc.
Engineering & Environmental Services

A Report Prepared for:

Univar USA Inc.
3950 NW Yeon Avenue
Portland, Oregon

FINAL STORMWATER PATHWAY INVESTIGATION WORK PLAN

UNIVAR USA INC.
PORTLAND, OREGON

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LIST OF ACRONYMS

AOC	Administrative Order on Consent
ASPP	Accidental Spill Prevention Plan
AST	Aboveground Storage Tank
BES	Portland Bureau of Environmental Services
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COI	Chemical of Interest
CSM	Conceptual Site Model
DCA	Dichloroethane
DCE	Dichloroethene
DCQAP	Data Collection Quality Assurance Plan
DEQ	Oregon Department of Environmental Quality
DNAPL	Dense Non-Aqueous Phase Liquid
ECSI	Oregon DEQ Environmental Cleanup Site Information
EPA	U.S. Environmental Protection Agency
EXW	Extraction Well
IBC	Intermediate Bulk Container
ICM	Interim Corrective Measure
JSCS	Joint Source Control Strategy
LNAPL	Light Non-Aqueous Phase Liquid
MC	Methylene Chloride
MDL	Laboratory Method Detection Limit
µg/L	Microgram per Liter
µg/kg	Microgram per Kilogram
MRL	Laboratory Method Reporting Limit
MSDS	Material Safety Data Sheet
NPDES	National Pollution Discharge Elimination System
OERS	Oregon Emergency Response System
OFM	State of Oregon Fire Marshal
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethane
PFB	Portland Fire Bureau
PZ	Piezometer
QA/QC	Quality Assurance / Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RQ	Reportable Quantity

ACRONYMS (Continued)

SMW	Shallow Monitoring Well
SPI	Stormwater Pathway Investigation
SVE	Soil Vapor Extraction
SVOC	Semi-volatile Organic Compound
SWPCP	Stormwater Pollution Control Plan
TCA	Trichloroethane
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbon
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VTS	Vapor Treatment System
WP	Work Plan
WTS	Water Treatment System

1.0 INTRODUCTION

This Final Stormwater Pathway Investigation Work Plan (SPI Work Plan) has been prepared on behalf of Univar USA Inc. (Univar) as part of the Corrective Measures Implementation (CMI) Design at the Univar property in Portland, Oregon. The Final SPI Work Plan is being submitted consistent with the Final CMI Work Plan (PES, 2008a) prepared pursuant to the Amendment to the Administrative Order on Consent to Implement Corrective Action 1087-10-18-3008 (AOC Amendment) dated August 1, 2007, between the U.S. Environmental Protection Agency, Region 10 (EPA) and Univar. The Final SPI Work Plan was prepared in response to EPA's letter dated February 23, 2010 and entitled Approval with Conditions for the Revised SPI Work Plan (EPA, 2010). The conditional approval letter (EPA, 2010) was received on February 26, 2010 (by PES) and required that the Final SPI Work Plan address the conditions and comments contained in the letter. This Final SPI Work Plan addresses EPA's comments and does not include any other modifications.

The SPI Work Plan describes the investigation of stormwater pathways to confirm that the final corrective measure for Univar prevents significant off-site migration of Univar operational materials to the Willamette River. The final corrective measure for Univar is described in detail in the Corrective Measures Study (CMS) report (PES, 2006a), summarized in the Statement of Basis (EPA, 2006), and includes the following major components:

- Continued operation and maintenance of the existing groundwater pump and treat corrective measure;
- Expanding the existing soil vapor extraction (SVE) system in the source area;
- Source area groundwater extraction;
- Monitoring of the lower aquifer;
- Natural attenuation for groundwater;
- Engineering and institutional controls; and
- Evaluation of the potential for off-site migration of hazardous substances through the stormwater system.

More recently, however, it has been determined that there are additional factors which must be considered in development of the final corrective measure and have resulted in the addition of scope to this work plan. During site investigations conducted in 2008 and 2009 in support of the final remedy design, both light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) have been discovered on the property. Also, during the reapplication process for renewing Univar's National Pollution Discharge Elimination System (NPDES) Waste Discharge Permit No. 101613, DEQ included dissolved iron as a potential constituent to be included in the next permit. Taken together, these factors have caused Univar to revisit the final corrective measure and may result in modifying the remediation strategy on the property.

In addition, the potential inclusion of dissolved iron benchmarks in the renewed NPDES permit has resulted in the requirement that iron be investigated as part of the Final SPI Work Plan.

Discussion of Previous Work Plans. Univar submitted a Draft SPI Work Plan in June 2008 (PES, 2008e) to EPA for review. EPA provided Univar with preliminary comments on the Draft SPI Work Plan in a September 3, 2008 e-mail. These comments included written comments on the Draft SPI Work Plan provided by the City of Portland (COP, BES 2008b) and the Oregon Department of Environmental Quality ([DEQ], 2008). After additional discussions regarding the SPI between Univar and EPA, EPA issued additional comments in a letter dated February 29, 2009 (EPA, 2009). EPA and Univar met on March 13, 2009 to discuss the approach for addressing the comments and revising the work plan.

In their comments on the Draft SPI Work Plan (EPA, 2009), EPA recommended that Univar change the sampling approach to a phased approach which would first focus on whether or not the stormwater from the property is contributing a significant source of contaminants to the stormwater conveyance system (which ultimately discharges to the Willamette River). Univar agreed with this approach and modified the work plan. EPA also required that Univar address the comments from COP and DEQ, some of which would be effectively deferred to possible future work plans based on the EPA-recommended sampling approach.

Consistent with the EPA's response letter (EPA, 2009) and the March 13, 2009 meeting, Univar submitted the revised SPI Work Plan in June 2009 (PES, 2009d). During the March 2009 meeting, Univar had offered to submit a responsiveness summary letter with the revised work plan to summarize the EPA, DEQ, and COP comments and to identify which comments were being deferred to future phases of work. However, submittal of the responsiveness letter was delayed until January 11, 2010 (PES, 2010) due initially to issues related to installing a new manhole and access to the storm sewer main, and then because of the draft corrective action design work underway.

1.1 Purpose

The purpose of the SPI Work Plan is to: (1) define the scope of work, (2) provide guidance for field investigation activities, (3) provide guidance for field sampling activities, (4) identify quality assurance (QA) procedures that will be implemented during sampling activities and laboratory analyses, and (5) fulfill the EPA requirements that pertain to documentation of sampling and analysis, and quality assurance/quality control (QA/QC). The SPI Work Plan generally follows the structure and guidelines presented in DEQ's *Guidance for Evaluating the Stormwater Pathway at Uplands Sites*, Public Review Draft dated January, 2009 (DEQ, 2009).

The investigation described in the SPI Work Plan will be conducted consistent with the Statement of Basis (EPA, 2006), and consistent with the criteria and procedures described in EPA's and DEQ's Joint Source Control Strategy ([JSCS] EPA/DEQ, 2005), the DEQ SPI guidance (DEQ, 2009), *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling* (Anchor/Integral 2007), and the comments on the Draft SPI Work Plan. The investigation will be performed in addition to the routine stormwater monitoring and maintenance activities being conducted consistent with Univar's National Pollution Discharge Elimination System (NPDES) Waste Discharge Permit No. 101613 and Stormwater Pollution Control Plan (SWPCP, PES, 2008d). Specifically, the SPI Work Plan addresses comments from the City of Portland Bureau of Environmental Services (BES) to EPA (BES, 2006b) on the proposed Statement of Basis (EPA, 2006). A copy of the BES letter is included in Appendix A. The BES letter identifies several chemicals that have been discovered downstream of the Univar property in both storm sewer main solids and Outfall No. 18 river sediments. It is important to note that the downstream drainage pipes and river sediments receive runoff from numerous industrial sources and the chemicals detected in those sediments cannot be assumed to have originated from Univar's property.

The results of the investigation will be submitted in a report according to the Revised CMI Implementation Schedule (PES, 2009c). The data gathered from this investigation will be incorporated into Univar's conceptual site model ([CSM] PES, 2006a).

1.2 SPI Work Plan Organization

The SPI Work Plan generally follows the structure and guidelines presented in DEQ SPI guidance (DEQ, 2009). The remainder of the SPI Work Plan is organized as follows:

- **Section 2 – Background:** briefly summarizes background information for Univar including property description and history, description of Univar's operations, description of releases, description of the stormwater drainage system, and stormwater pollution control measures;

- **Section 3 – Regulatory History:** briefly describes the regulatory history and permitted activities at Univar's property associated with the stormwater pathway investigation. These activities include soil and groundwater investigation and cleanup required by EPA, permitted stormwater discharge, permitted discharge of the interim corrective measures treatment system, permitted discharge of Univar's industrial wastewater, and hazardous waste management activities associated with operations and remediation activities at the property;

- **Section 4 – Other Investigations:** briefly describes other investigations performed at the property including storm sewer inspections and soil sampling related to property improvements;

- **Section 5 – Stormwater Pathway Investigation Rationale:** presents the investigation rationale;

- **Section 6 – Chemicals of Interest:** describes the rationale for selecting the chemicals of interest (COIs) based on chemicals associated with Univar operations and cleanup activities, other chemicals identified by the City of Portland and required by EPA to be included in this SPI, and chemicals and parameters identified and recommended by EPA;

- **Section 7 – Pre-Sampling Activities:** presents the process for preparing the City owned and operated 42-inch storm sewer main for sampling, evaluating the current condition of the storm sewer main, and evaluating the potential for groundwater infiltration to the storm sewer main;

- **Section 8 – Sampling and Analysis Plan:** presents the sampling and analysis plan for stormwater and sediment sampling;

- **Section 9 – Quality Assurance / Quality Control:** presents QA/QC procedures for field activities and laboratory analyses, non-conformances, and records control;

- **Section 10 – Reporting:** presents reporting requirements;

- **Section 11 – Limitations:** describes the limitations for the use of this report; and

- **Section 12 – References:** describes the references used to prepare this report.

2.0 BACKGROUND INFORMATION

This section provides a brief background discussion of Univar's operations, documented releases, and stormwater drainage and pollution control measures. For more detailed information on Univar's history, previous environmental investigations, hydrogeological conditions, the nature and extent of documented contamination, and the development and evaluation of corrective action alternatives, refer to the Statement of Basis (EPA, 2006) and the Final CMS Report (PES 2006a). Univar's stormwater pollution control measures are documented in the SWPCP (PES 2008d).

2.1 <u>Description and History</u>

The Univar property is located at 3950 NW Yeon Avenue in an industrial area northwest of downtown Portland, Oregon (Figure 1). The property is zoned "heavy industrial" and lies within an area designated as an Industrial Sanctuary in the City of Portland Comprehensive Plan. The property is located in the southwest quarter of the southwest quarter of Section 20 and the northwest quarter of the northwest quarter of Section 29, Township 1 North, Range 1 East. The property is located on Tax Lot 1800 at Latitude 45° 32' 55" and Longitude -122° 43' 22".

Properties near the Univar property include American Steel, McWhorter (also known as McCloskey Varnish), and the Shell (formerly Texaco) petroleum tank farm to the west; Container Recovery Inc. (formerly Convoy) and ABF/ASNR Trucking (formerly ANR) to the east and southeast; and Index and Wilhelm Trucking to the south. The area has been industrialized for approximately 60 years.

Univar has packaged, stored, and distributed bulk chemical products at the property since 1947. Bulk chemical products were formerly stored in 13 underground storage tanks (USTs), all of which were removed in 1985. At the time of removal, the tanks were tested and found to be tight.

Univar began recycling spent chlorinated solvents in 1973, together with the storage of certain hazardous wastes associated with those recycling activities. The recycling and storage of associated hazardous wastes was fully discontinued in 1987 and the hazardous wastes storage area of the property underwent procedural closure under Section 3008(a) of Resource Conservation and Recovery Act (RCRA) in 1988.

2.2 <u>Univar Operations</u>

The Univar property encompasses approximately 9.5 acres, including approximately 2 acres of warehouses and office space, a railroad spur, loading dock, and aboveground storage tanks (ASTs). More than 99 percent of the property is capped with buildings, the concrete loading dock area, and asphalted apron and parking areas. The property is surrounded by a chain link fence with access via two security gates at either side of the front of the property. Refer to Figures 2 and 3 for site maps and the location of property features discussed below.

Univar receives, packages, stores and distributes a wide variety of industrial chemical products. The majority of which are handled in consumer end-user packaging within the interior operational areas (e.g., covered drum storage, dry packaging area, and general warehousing) that are not exposed to rain, snow, snowmelt, or runoff. These covered areas also include satellite waste accumulations and 90-day hazardous waste storage areas. Packaged chemical products are generally received along the west side of the property, and are shipped from the east side of the property with the exception of small packages, which are received and shipped from the northeast corner of the covered drum storage area.

According to the CMS report (PES, 2006a), Univar has also historically handled bulk solvents in the following areas: in and around the corrosive tank farm, along the rail spur from just north of the corrosive tank farm to south of the drum fill area, on the dock in and around the drum fill area, at the solvent recycle area, and in and around the solvent tank farm. Bulk chemical transfers are made from rail cars and trucks into tank storage, and intermediate bulk containers (IBC's). Direct product transfers are also made from rail cars to trucks. Rail car unloading and transfer occurs along the west side of the property along with truck transfers, loading, and unloading. Bulk chemicals delivered in tanker trucks and rail cars are stored in tanks on the southwest portion of the property. The tanks are located within secondary containment berms.

The majority of the bulk products currently handled at the property are petroleum-based solvents containing volatile organic compounds (VOCs). Univar maintains a current inventory of the storage tank contents. Table 1 lists the bulk product storage tanks, the size of the tanks, and the tank contents as of May 2009. Table 2 includes a list of bulk products handled at the property as of May 2009. Univar maintains a comprehensive file of material safety data sheets (MSDSs) for all chemicals handled; these MSDSs can contain additional information describing the specific chemical constituents.

2.3 Chemical Release and Incident History

Records review indicates historical releases at the property. Univar reviewed its internal records, DEQ records, State of Oregon Fire Marshal (OFM) records, City of Portland Fire Bureau (PFB) records, and City of Portland BES records.

The following sources of records were reviewed:

- Univar's spill records are documented in the Accidental Spill Prevention Plan ([ASPP] Univar, 2006). According to the ASPP, reportable quantity (RQ) spills are reported to DEQ through the Oregon Emergency Response System (OERS). Univar follows state and federal guidance for defining RQ spills and reporting procedures. Other than the list in the ASPP, Univar does not maintain historical records of reportable spills.

- Information posted on the DEQ Environmental Cleanup Site Information (ECSI) webpage for Univar: http://www.deq.state.or.us/lq/ECSI/ecsidetailfull.asp?seqnbr=330.

- A telephone interview with Ms. Kimberly Van Patten of OERS on May 22, 2008 which indicated that there are no records of RQ spills or incidents at 3950 NW Yeon Avenue, Portland, Oregon, 97210 since 1999. Ms. Van Patten did not have access to records prior to 1999 and indicated that Mr. Ray Hoy at the DEQ NW Regional Office may have access to these records.

- A telephone interview with Mr. Ray Hoy of DEQ on May 23, 2008 which indicated that there are no records of RQ spills or incidents at 3950 NW Yeon Avenue since 1999. Mr. Hoy said that he would research the files for available records prior to 1999. No additional information has been made available by DEQ at the time of writing this report.

- Information posted from the OFM incident response database for 3950 NW Yeon Avenue was reviewed online at the following website: http://www.oregon.gov/OSP/SFM/CR2K_Incident_Database.shtml. The database includes records from 1986 through 2004.

- A telephone interview with Mr. Mark Bunster of the PFB on May 28, 2008 which indicated that there are no records of hazardous materials response or chemical spills at 3950 NW Yeon Avenue since 1998. Mr. Bunster indicated that he did not have access to records prior to 1998.

- Review of BES file records since 1991 did not indicate any chemical spills at the property. BES records provide documentation for the following incidents prior to 1991:

    - August 15, 1980 – A small (less than 1 gallon) of methylene chloride (MC) was spilled during product transfer operations. The spill was cleaned up with oversight from DEQ. It is not clear how much, if any, of this spill reached the storm drain system.

    - September 8, 1983 – A 515 gallon release of trichloroethene (TCE) occurred when a site gauge on a storage tank broke. This spill reportedly reached the onsite storm drain system. A shut-off valve in the storm drain was closed and appeared to prevent the TCE from reaching the City's storm main. The spill was cleaned up in coordination with EPA and DEQ.

The spill and incident records maintained at the property and the various agencies are generally consistent and complementary. Releases of the following chemicals are documented in the records listed above: MC, TCE, 1,1,1-trichloroethane (TCA), toluene, acetone, nitric acid, phosphoric acid, and 15-5-9 surfactant. OERS records also list an incident involving 0 gallons of aqua ammonia, but do not provide any additional data.

Figure 4 shows the general location of the three documented releases of solvents as reported by the RCRA Facility Investigation (RFI) Report (HLA, 1993). This figure was presented as Figure 2-11 in the CMS report (PES, 2006a) to show the approximate location of high concentrations of volatile VOCs in soil and soil vapor as well as approximating the area of source contamination based on locations of documented solvent releases and subsurface VOC contamination. Further discussion of subsurface contamination and cleanup activities is presented in Section 3.1.

2.4 Stormwater Drainage

Precipitation falling within the Univar property is collected by a series of catch basins and roof drains located throughout the property (Figure 3). The catch basins route water through underground stormwater conveyance lines and manholes, to storm sewer mains operated, owned, and maintained by the City of Portland. Stormwater runoff from building roof tops is also collected by the City storm sewer mains via underground stormwater conveyance lines.

The drainage map (Figure 3) and Table 3 describes the drainage areas, storm drain system, and sampling points. Six general stormwater drainage basin areas have been defined based on the existing grading, stormwater sewer system, and catch basins. Drainage Area Nos. 1, 2, 3, 4, and 6 are connected to the City of Portland owned and maintained 42-inch storm sewer main on the east side of the property; the 42-inch storm sewer main flows to the north which then connects to another 42-inch storm sewer main which flows to the northwest and is located in the frontage road adjacent to NW Yeon Avenue. Drainage Area No. 5 is connected to the City of Portland owned, operated, and maintained 8-inch storm sewer line on the American Steel property which flows to the southwest. Both of these City owned, operated, and maintained storm sewer mains ultimately discharge to the Willamette River via Outfall No. 18. There are no known areas of stormwater run-on to the Univar property from adjacent properties. However, both the 42-inch and 8-inch City owned, operated, and maintained storm sewer mains convey stormwater from adjacent and nearby properties.

With the notable exception of the City owned, maintained and operated 42-inch storm sewer main which is located within an easement (granted by Univar to the City of Portland) along Univar’s eastern property boundary, Univar maintains the stormwater drainage system on its own property. Hereinafter this will be called the “Univar maintained stormwater drainage system” which specifically excludes the City owned, operated and maintained storm sewer main located along the eastern property boundary. The Univar maintained stormwater drainage system includes roof drains, catch basins, stormwater conveyance piping, manholes, and emergency shut-off valves. At the writing of this report it is unclear as to whether the Univar maintained stormwater drainage system is owned by Univar or the City of Portland.

The central and southern portions of the property are the primary areas of industrial activity where the main product handling and storage operations are located. These areas are serviced by Drainage Area Nos. 1, 2, 3, and 4.

- Drainage Area No. 1 - Approximately 94,100 square feet (sq. ft) of impervious surfaces including the southern half of the rail spur, drum fill area, and solvent tank farm area;

- Drainage Area No. 2 – Approximately 107,300 sq. ft of impervious surfaces including the eastern drive, covered drum storage structures, and the eastern half of the warehouse;

- Drainage Area No. 3 - Approximately 65,900 sq. ft of impervious surfaces in the center of the property including the corrosive tank farm and the central rail spur; and

- Drainage Area No. 4 – Approximately 77,200 sq. ft of impervious surfaces at the southern end of the property including the remediation building.

The final two drainage areas service the northern portions of the property only limited product handling activity occurs.

- Drainage Area No. 5 – Approximately 35,300 sq. ft of impervious surface west of the warehouse that is used for truck unloading to the warehouse and employee parking; and

- Drainage Area No. 6 - Approximately 40,200 sq. ft of impervious surface at the northern end of the property that is generally used for worker vehicle parking. Drainage Area No. 6 also has approximately 9,600 square feet of pervious planter area located in front of the main office building.

Discussion of stormwater sampling and stormwater pollution control measures is described in Section 3.3.

3.0 REGULATORY HISTORY

Univar operates within the rules and guidelines of local, state, and federal regulations. Since the SPI Work Plan is limited to the investigation of stormwater pathways to confirm that the final corrective measure for Univar prevents off-property migration of contamination to the Willamette River, the discussion of regulatory history will be limited to the following topics:

- RCRA cleanup related activities under Section 3008(h) of RCRA as required by EPA Region 10 consistent with the provisions of the Administrative Order on Consent (AOC) dated June 15, 1988 (EPA, 1988) and Amendment to the AOC to Implement Corrective Action 1087-10-18-3008 (AOC Amendment) dated August 1, 2007 (EPA, 2007);

- Non-stormwater discharge monitoring for treated groundwater from the Interim Corrective Measure (ICM) groundwater extraction and treatment system in accordance with NPDES Waste Discharge Permit No. 101613 (DEQ, 2004);

- Stormwater discharge monitoring in accordance with NPDES Waste Discharge Permit No. 101613 (DEQ 2004); and

- Wastewater discharge monitoring in accordance with City of Portland BES Industrial Wastewater Discharge Permit No. 400.025 (BES, 2006a).

- Hazardous Waste Management.

Consistent with DEQ SPI guidance (DEQ, 2009), the SPI Work Plan includes summaries of historical chemistry data and comparison of sample results to screening level values (SLV) published in the guidance. This comparison is used to help develop specific contaminants of interest (COI) associated with Univar operations and cleanup activities for evaluation in the stormwater pathway investigation. According to the JSCS (EPA/DEQ, 2005) SLVs are used by DEQ to assess threats to the Willamette River from potentially complete contaminant migration pathways (e.g., soil, stormwater, groundwater) from upland sources. The JSCS has clarified that SLV exceedance(s) does(do) not necessarily indicate that an upland source of contamination poses an unacceptable risk to human or ecological receptors, but rather that it requires further consideration of source control using a weight-of-evidence evaluation.

3.1 RCRA Cleanup Activities

Univar began recycling spent chlorinated solvents in 1973 along with the storage of certain hazardous wastes associated with recycling activities. The recycling and storage of associated hazardous wastes was discontinued in 1987. In July 1986, EPA issued a Unilateral Order to Van Waters and Rogers (Univar's predecessor in interest) under Section 3013 of RCRA to conduct an investigation of soil and groundwater at the property. EPA terminated the Unilateral Order in April 1988 and the hazardous waste storage facility underwent procedural closure under Section 3008(a) of RCRA as required by EPA Region 10 consistent with the provisions of the AOC dated June 15, 1988 (EPA, 1988). The provisions and requirements of the AOC, along with other relevant RCRA regulations and guidance, provided the basis for all environmental activities including investigation activities, interim corrective measures (ICMs), and the performance of the CMS (PES 2006a).

The initial field investigations were documented in the RFI report (HLA, 1993) submitted under the original 1988 AOC. These investigations included installation of soil boring and groundwater monitoring wells, and collection and analysis of soil and groundwater samples. Univar implemented quarterly and semiannual groundwater monitoring programs which are ongoing. Constituents that were detected in soil included: PCE, TCE, TCA, 1,2-dichloroethene (1,2-DCE) vinyl chloride, and MC. Constituents detected in groundwater included benzene, toluene, ethyl benzene, xylene, PCE, TCE, DCE, TCA, vinyl chloride, and MC.

Since the 1993 RFI report, Univar has performed supplementary site characterizations, ICM design and implementation work, deep aquifer evaluations, regional groundwater survey, and completed the CMS report as required by the original 1988 AOC. After completion of the requirements of the original AOC, and in particular the preparation and approval of the CMS report, EPA prepared a Statement of Basis (EPA, 2006) describing the proposed corrective measure selected for implementation by EPA. At the completion of the public review period, EPA issued a final decision letter dated September 29, 2006. EPA also issued an Amendment to the AOC to Implement Corrective Action 1087-10-18-3008 (AOC Amendment) dated August 1, 2007 (EPA, 2007). The amended AOC provided the basis for performing the CMI, which also includes this SPI Work Plan.

3.1.1 Historical Soil and Groundwater Sampling

In the CMS report and Statement of Basis, Univar identified 20 chemicals of concern (COC) in soil and groundwater based on human health risk exposure pathways (i.e., inhalation, dermal contact, ingestion). The COCs include 18 VOCs and 2 semi-volatile organic compound (SVOC) polycyclic aromatic hydrocarbons (PAH). Univar developed the COC list based on historical operations, identified spills/releases, environmental sampling results, and ICM monitoring.

Table 4 lists the concentrations of COCs that have been detected in shallow soil and groundwater, and published SLVs for evaluating the stormwater pathway at upland sites. Table 4 also includes concentrations of detected VOCs and SVOCs not listed as COCs in the CMS report, and includes results of COCs and non-COCs that were discovered in soil sampling performed in April and September 2008. Soil sampling was performed in accordance with the CMI Design Investigation Work Plan (PES, 2008b) and CMI Supplemental Design Investigation Work Plan (PES, 2008f). The 2008 soil sampling results were reported in the second quarter of 2008 progress report (PES, 2008h) and in a data summary letter to EPA dated December 8, 2008 (PES, 2008j). Groundwater sampling results from 2008 and 2009 were reported in quarterly progress reports (PES, 2008c,h,i; PES, 2009a,b).

In general, soil and groundwater samples collected for the RFI report were analyzed by EPA Methods 8010, 8020, and 8240. More recently collected soil and groundwater samples were analyzed by EPA Method 8260.

<u>Soil Data.</u> The soil data presented in Table 4 include data from samples collected within the top 15 feet (ft) below ground surface (bgs) as this shallow zone is important to the evaluation the groundwater to stormwater pathway.

For the purposes of initial screening, soil concentrations listed in Table 4 are based on highest soil concentrations published in the RFI report, CMS report and draft soil results from the CMI design investigation. It should also be noted that historical soil sampling associated with RCRA cleanup activities has been conducted mainly in the areas of historical spills and releases and not near the perimeter of the property near the 42-inch storm sewer mains. Of the 20 COCs identified in the CMS Report, only three COCs have been assigned SLVs by DEQ: indeno(1,2,3-cd)pyrene, tetrachloroethene (PCE), and TCE.

<u>Groundwater Data.</u> For the purposes of initial screening, groundwater concentrations in Table 4 are based on the highest shallow monitoring well concentrations published in the 2008 and 2009 quarterly progress reports.

Two sets of groundwater concentrations are presented: concentrations in all wells, and concentrations in only those wells adjacent to the 42-inch storm sewer mains running along the eastern property boundary and in the NW Yeon Avenue frontage road. These wells include shallow groundwater monitoring wells SMW-3, -9, -10, -11, 16, -17, -18, -21, -23, -24, and -27; shallow piezometers PZ-3 and -9; and shallow groundwater extraction well EXW-4A (Figure 5). The groundwater concentrations in wells adjacent to 42-inch storm mains exceed SLVs for six COCs: benzene, 1,1-dichloroethane (DCA), 1,2-DCA, PCE, TCE, and vinyl chloride. In addition, no groundwater sampling has been done for two of the COCs - indeno(1,2,3-cd)pyrene and benzo(b)fluoranthene – due to the limited mobility of these compounds and extremely low likelihood of transfer from shallow soil concentrations to groundwater.

3.2 <u>Interim Corrective Measures</u>

In accordance with the original 1988 AOC, Univar has implemented a number of ICMs beginning in 1992 with a pilot-scale SVE system. A groundwater ICM, consisting of three groundwater extraction wells, was installed during late 2001 and early 2002. The groundwater ICM began operations in March 2002. The groundwater ICM provides hydraulic control of the groundwater contamination at the north and south ends of the plume perimeter and also removes contaminant mass. The extracted groundwater is treated by air stripping. Treated groundwater is then collected by the City of Portland owned and operated 42-inch diameter storm sewer main near the eastern property boundary, via catch basin CB-4C (Figure 3), under NPDES Waste Discharge Permit No. 101613.

The ICM system currently includes an SVE system consisting of six SVE wells and four groundwater extraction wells. The SVE vapors and air stripper off-gases are combined and treated in a common vapor phase treatment system. Results of current ICM activities are presented in the most recent quarterly progress reports submitted by Univar to EPA (PES 2009a, 2009b).

3.2.1 Historical Sampling Results

Monthly compliance monitoring samples are collected from the WTS discharge and analyzed for VOCs, cyanide, oil and grease, and pH. In Univar's entire operating history, VOCs have been detected only ten (10) times (i.e., sampling events) and exceeded discharge limits only twice. Cyanide, although detected six (6) times, has never exceeded discharge limits and oil & grease, detected two (2) times, have likewise never exceeded discharge limits. VOCs detected in WTS discharge samples included PCE, TCE, TCA, 1,2-DCE, 2-butanone (MEK), ethylbenzene, toluene, m,p-xylenes, and o-xylenes. However, VOCs have exceeded their respective permitted discharge limits only twice: August 2002 (1,2-DCE) and May 2005 (TCA and PCE). Each of the VOC discharge exceedances was attributed to a malfunction of the former resin adsorption vapor treatment system (VTS) and there have been no VOC detections in WTS discharge since the resin adsorption VTS was replaced in the summer of 2006.

For the purposes of initial screening, Table 5 lists the permitted discharge limits, the range of historical VOC detections in WTS discharge, and published SLV for evaluating the stormwater pathway at upland sites (DEQ, 2009). Table 5 also documents the number of times each VOC has been detected in the entire ICM operating history. Table 5 includes results reported through the first quarter of 2009 progress report (PES, 2009b).

3.3 Stormwater Discharge

Univar's stormwater pollution control measures are documented in the SWPCP (PES, 2008d) that has been prepared consistent with the NPDES Waste Discharge Permit No. 101613. The discharge permit was originally obtained by Univar in 1998 and renewed in 2004. The NPDES permit required stormwater monitoring and indicated that a SWPCP should be prepared for the property. The SWPCP works in conjunction with Univar's ASPP (Univar, 2006) and Contingency Plan (Univar 2005) and is written consistent with the requirements of DEQ's 1200-Z General Permit in effect in 2004 and was recently updated to address comments from the City of Portland (BES, 2008a) following up on its annual stormwater inspection conducted in February 2008.

Univar is currently in the reapplication process for renewing the NPDES permit with DEQ. DEQ has identified dissolved iron in discharge from the groundwater treatment system as a constituent that may need to be monitored for during the next permit cycle. Univar has been collecting samples of dissolved iron (and other metals) since January 2010 in support of the NPDES permit reapplication process.

3.3.1 Historical Sampling Results

Univar has been sampling the three discharge points two times per year (Figure 3) starting in the 1999/2000 rainy season. Typically, the first sample is collected in autumn when runoff first occurs and the second sample is collected at least 60 days later. Samples are analyzed for the parameters listed in the discharge permit.

Historical stormwater sampling results from the 1999/2000 through 2007/2008 rainy seasons have previously been submitted to DEQ and BES in annual reports (ITC, 2000, 2001b; PES, 2002, 2003, 2004, 2005, 2006b, 2007, 2008g). Table 6 includes a summary of all sample results through the 2007/2008 rainy season, waste discharge permit benchmark levels, and published SLV for evaluating the stormwater pathway at upland sites (DEQ, 2009). Draft results of water samples collected to support the NPDES permit reapplication process in 2010 are not included in Table 6. Final results will be submitted to DEQ by June 1, 2010 as requested by DEQ (DEQ, 2010).

3.4 Industrial Wastewater Discharge

Univar discharges industrial wastewater in accordance with City of Portland BES Industrial Wastewater Discharge Permit No. 400.025 (BES, 2006a). The industrial wastewater discharge permit works in conjunction with Univar’s ASPP (Univar, 2006) to define the specific practices and parameters for batch discharge of industrial wastewater from the neutralization area to the City’s sanitary sewer pursuant to the permit (Figure 3).

The permit allows Univar to batch discharge industrial wastewater twice per day between the hours of 8:00 am and 10:00 am and 1:00 pm and 3:00 pm, and requires pH monitoring on a per-batch basis prior to discharge. Univar performs pH adjustment using hydrochloric acid or sodium hydroxide to bring the batch pH within discharge limits (5.0 – 11.5 pH units). According to the DEQ ECSI database, there were a series of low pH discharges in 1984 and 1985 (0.8 to 3.2 pH units). According to the industrial wastewater discharge permit, there are only two violations of pH on record and no violations recorded during BES monitoring.

The industrial wastewater discharge permit lists the following materials potentially present in the waste stream: hydrochloric acid, phosphoric acid, sulfuric acid, formic acid, nitric acid, sodium hydroxide, potassium hydroxide, ammonium hydroxide, sodium hypochlorite, aluminum sulfate liquid, and triton 9-n-9 (i.e., surfactant). Table 7 lists the permit required discharge limits as well as other chemicals historically detected in the industrial wastewater, though not in quantities greater than 1 mg/L (on average). In general, the DEQ SLVs (DEQ, 2009) are less than the permitted discharge concentrations listed in the industrial wastewater Discharge Permit No. 400.025.

3.5 Hazardous Waste Management

Univar is listed as a large quantity generator of hazardous waste. Review of historical hazardous waste disposal records from 1992 through 2008 indicates a variety of hazardous waste materials properly disposed of off-site. A summary of the hazardous waste generation reporting history for the property has been prepared by DEQ and can be reviewed on their website: http://deq12.deq.state.or.us/FP20/Fpdetail.aspx?SiteID=1053.

4.0 ADDITIONAL INVESTIGATIONS

In addition to the RCRA related environmental investigations discussed in Section 3.0, other investigations related to Univar's operations and improvements have been performed. This section describes these additional investigations.

4.1 Storm Sewer Inspections

According to City of Portland BES records, the City owned and operated 42-inch storm sewer main along the eastern property boundary has been historically sampled and inspected. Additionally, in 1996 Univar conducted an inspection of the 42-inch storm sewer main at the request of DEQ and the City of Portland to assess the structural integrity of approximately 1,400 ft of the storm main. The inspection is documented in the storm sewer inspection field report (HLA, 1996).

Univar initially undertook only a video inspection of the City owned and operated 42-inch storm sewer main located within the easement on the Univar property. However the City sewer system was clogged with sediments and Univar was required to jet the line prior to finalizing the required video inspection. Waste characterization sampling of the sediments indicated the presence of PCE, TCE, cis-1,2-DCE, ethylbenzene, toluene, and total xylenes. Table 8 includes the sediment data from the line jetting, and published SLVs for evaluating the stormwater pathway at uplands sites (DEQ, 2009).

It is important to note that this City owned and operated 42-inch stormwater pipeline drains stormwater from a large area both upgradient and downgradient of Univar. This drainage area includes numerous other industrial facilities that are likely to be potentially significant sources of stormwater contamination.

The inspection revealed several broken, chipped, and pulled joints, and indicated that the joint separation was minor as several inches of the 4-inch long bell fittings were still fitted together. The inspection field report also noted areas of discolored piping and joints.

The inspection also revealed that the City's storm sewer main had a sagging section where approximately 12-inches of sediment and water collected in that section of the line. Otherwise, the City's 42-inch storm sewer main appeared in good condition with no structurally suspect areas and no deterioration of the interior pipe surface. There were no indications that the sediment buildup in the City's storm sewer main originated from the Univar property. The inspection is documented in the storm sewer inspection field report (HLA, 1996).

4.2 Soil Sampling for East Drive Re-Paving

Univar has performed three rounds of soil sampling in 2002, 2007, and 2008 to characterize shallow soils that have been or may be (in the future) removed during repaving of the eastern driveway between the eastern loading dock and the eastern property line. The soil sampling identified low levels of certain metals, VOCs, pesticides, pentachlorophenol, and total petroleum hydrocarbons (TPH). This data was collected for internal waste characterization and has not been published elsewhere.

For the purposes of screening, Table 9 includes a list of the highest concentration of detected analytes and published SLVs for evaluating the stormwater pathway at upland sites (DEQ, 2009). Analytes that were not detected above laboratory MRLs are not included in Table 9. A comparison of detected analytes and SLVs includes the following:

- Metals – All detected metals concentration were less than SLVs with the exception of lead.
- Organochlorine Pesticides – All detected pesticides were greater than the SLVs.
- VOCs – PCE and TCE were above SLVs. DEQ SPI guidance does not list SLVs for the remaining VOCs detected in soil samples.
- SVOCs – Pentachlorophenol was the only detected SVOC and was well below the SLV. The laboratory MRLs were typically below SLVs.
- TPH – Diesel range and oil range TPH organics were detected in several locations. DEQ SPI guidance does not list SLVs for TPH.

It should be noted that shallow soil samples were also analyzed for chlorinated herbicides and there has not been any detection of chlorinated herbicides above the laboratory MRLs.

5.0 STORMWATER PATHWAY INVESTIGATION RATIONALE

As defined by the EPA's Statement of Basis (EPA, 2006) the SPI is intended to confirm that the corrective measures Univar has implemented are preventing potential migration of alleged contamination from Univar's activities to the Willamette River via the City's storm sewer system. To accomplish this overall objective, a phased approach has been developed. The first phase, which is the subject of this work plan, evaluates whether the stormwater runoff from the Univar property is a significant source of contaminants. If the first phase activities including sampling and analysis of stormwater and sediments concludes that the Univar property is not a significant source of contaminants, the overall objective will have been met and the investigation will terminate at that point, If on the other hand the first phase of work determines that Univar is a significant source of contaminants to the stormwater system, then a second phase investigation will be conducted that would attempt to identify the specific sources of this contamination (i.e., source tracing). If a second phase of work is required, a separate work plan will be prepared and submitted to EPA, DEQ, and COP for review.

The SPI Work Plan, which addresses the first phase of the SPI, includes the following major components:

- An evaluation of the potential for contaminants to be released to the stormwater system from the Univar property and development of potential contaminants of interest (COIs);
- Conducting pre-sampling activities to evaluate and prepare the City owned 42-inch storm sewer main for sampling;
- Sampling of the stormwater in the City owned 42-inch storm sewer main immediately upstream and downstream of the Univar property, including collecting whole water stormwater samples and inline sediment trap samples; and
- Evaluation of whether contaminated groundwater could enter the stormwater system.

5.1 <u>Evaluation of Potential Contaminants</u>

The potential COIs include materials that have the potential to migrate from Univar's property to the Willamette River. A list of potential COIs are developed in Section 6.0 from the following:

- Products associated with Univar's operations and cleanup activities that may migrate into the City's storm sewer;
- Chemicals identified by the City of Portland alleged to have been discovered downstream of the Univar property in stormwater conveyance pipes and/or in Willamette River Outfall No. 18 sediments (BES, 2006b); and
- Chemicals identified by EPA as Portland Harbor COIs (EPA, 2008).

5.2 Pre-Sampling Activities

Before stormwater and sediment sampling can occur in the 42-inch storm sewer main, several preliminary tasks must be conducted to ensure that the sampling activities are as representative as possible. These pre-sampling tasks, which are described in detail in Section 7.0, include:

- Cleaning the 42-inch storm sewer main from proposed upstream sampling manhole on the adjacent Wilhelm Trucking property to the proposed downstream sampling manhole located in the ODOT right-of-way near the northeast corner of the Univar property.

- Conducting a video survey of the City owned 42-inch storm sewer main after the line has been cleaned to document current conditions. Locations of disrepair and potential groundwater infiltration will be documented for possible further evaluation.

Refer to Section 7.0 for further discussion.

5.3 Stormwater and Sediment Sampling

A sampling and analysis plan (SAP) has been prepared for stormwater and sediment trap sampling during the 2010/2011 water year. As noted above, the stormwater and in-line sediment sampling will be conducted in the 42-inch storm sewer main immediately up and downstream of the Univar property. Three stormwater sampling events will be conducted during the 2010/2011 rainy season. Sediment samples will be collected using in-line sediment traps that will be deployed throughout the rainy season. Samples will be submitted to an analytical laboratory for analysis of the COIs described in Sections 6.0 and 8.0. The stormwater sampling will be conducted concurrent with the routine SWPCP sampling (PES, 2008d). Refer to Section 8.0 for further discussion.

5.4 Evaluation of Groundwater to Stormwater Pathway

The groundwater to stormwater pathway will be evaluated by plotting groundwater elevations relative to property and City of Portland stormwater conveyance pipe invert elevations. Sections of conveyance piping in disrepair or potential groundwater infiltration (as discovered by the video survey) will be examined for evidence of groundwater infiltration. If significant groundwater infiltration is observed, Univar will prepare a supplemental sampling plan to collect and analyze groundwater samples. Refer to Section 7.4 for further discussion.

6.0 CHEMICALS OF INTEREST

This section identifies the COIs that will be evaluated by the SPI Work Plan. COIs evaluated for the SPI Work Plan are specific chemicals or categories of chemicals that have the realistic potential to enter the City of Portland storm sewer system. As noted previously, the list of potential COIs is being developed from the following three categories of chemicals:

- Products associated with Univar operations and cleanup activities that may migrate into the City's storm sewer;
- Chemicals identified by the City of Portland that have been discovered downstream of the Univar property in stormwater conveyance pipes and/or in Willamette River Outfall No. 18 sediments (BES, 2006b); and
- Chemicals identified by EPA as Portland Harbor COIs (EPA, 2008).

Only those chemicals listed in the DEQ SPI guidance for evaluating the stormwater pathway at upland sites (DEQ, 2009), related to historical operations and cleanup activities, identified by the City of Portland (BES, 2006b) and EPA (EPA, 2008), and are reasonably likely to reach the Willamette River through stormwater Outfall 18 will be retained in the SPI Work Plan. These retained chemicals will be defined as the COIs.

6.1 Chemicals Associated with Univar Operations and Cleanup Activities

This section summarizes the chemicals associated with Univar operations and cleanup activities and provides the rationale for selecting chemicals to be included as COIs. As described earlier, there are several chemicals associated with historical operations and cleanup activities.

6.1.1 Historical Spills and Releases

As described in Section 2.2 and 2.3, there have historically been relatively few chemical spills and incidents at the property. These chemicals spilled include TCE, TCA, toluene, methylene chloride, acetone, nitric acid, phosphoric acid, and surfactant. Only TCE, TCA, toluene, methylene chloride, and acetone are listed in DEQ SPI guidance, and are thus retained as COIs. While nitric acid and phosphoric acid are not retained as specific COIs, potential impacts from these chemicals will be evaluated through inclusion of pH as a monitoring parameter. Surfactants, although historically managed in bulk, are no longer handled in bulk containers or tank and therefore are not retained.

6.1.2 RCRA Cleanup Activities

As described in Section 3.1, 37 VOCs and 5 SVOCs were detected in soil and groundwater samples that were collected as part of RCRA remediation activities are considered (see Table 4). All 37 VOCs and 5 SVOCs are either listed as COCs in the CMS report (PES, 2006), have been detected in soil and groundwater samples, and/or are listed in DEQ SPI guidance and are thus retained as COIs.

6.1.3 Non-Stormwater Discharge Monitoring

As described in Section 3.2, chemicals associated with permitted non-stormwater discharge sampling of the ICM WTS are considered. These include the chemicals and parameters listed in the permit (10 VOCs, cyanide, oil and grease, and pH), and 5 other historically detected VOCs (see Table 5). Since the WTS discharges directly to the City owned and maintained storm sewer system, all 15 VOCs, cyanide, oil and grease, and pH are retained as COIs.

6.1.4 Stormwater Discharge Monitoring

As described in Section 3.3, chemicals and parameters associated with stormwater discharge sampling include copper, lead, zinc, dissolved iron, TSS, oil and grease, and pH (see Table 6). These chemicals and parameters are retained as COIs since this water directly discharges to the City owned and operated stormwater conveyance system.

6.1.5 Wastewater Discharge Monitoring

As described in Section 3.4, chemicals and parameters associated with permitted industrial wastewater discharge from Univar's neutralization area include 11 metals, 7 VOCs, 5 SVOCs, chlordane, sulfide, sulfate, ammonia, cyanide, oil and grease, and pH (see Table 7). The City of Portland BES has suggested that since these chemicals are associated with Univar's operations and are present in industrial wastewater discharge, the chemicals may also be present in stormwater discharged from the property (BES, 2006b). The City's implication is incorrect since as a result of Univar's housekeeping and chemical handling practices (i.e., dedicated piping and extensive use of drip pans) it is unreasonable to assume that chemicals present in industrial wastewater discharge will also be present in stormwater discharged from the property. Additionally, because the neutralization area is directly plumbed to the sanitary sewer, there is almost no potential for actual industrial wastewater to enter the storm sewer system. In order to address BES's concerns and EPAs comments (February 2010) chemicals that are identified in the industrial wastewater discharge permit are retained as COIs.

6.1.6 Storm Sewer Inspections

As described in Section 4.1, chemicals detected in sediment samples associated with the 1996 line jetting of the City owned and operated 42-inch storm sewer main that runs alongside Univar's eastern property boundary include PCE, TCE, cis-1,2-DCE, ethylbenzene, toluene, and xylenes (see Table 8). The chemicals detected in sediment samples associated with cleaning of the 42-inch storm sewer main are retained as COIs.

6.1.7 Property Improvements Soil Sampling

As described in Section 4.2, chemicals detected in shallow soil samples in the eastern driveway include 5 metals, 7 organochlorine pesticides, 9 VOCs, pentachlorophenol, and TPH (see Table 9). Since potentially exposed soil in the eastern driveway has the possibility of entering the storm sewer system during storm events, all chemicals detected in shallow soil samples, except barium, are retained as COIs. Barium is not retained because this metal is not listed in DEQ SPI guidance and there is no known source of this metal related to Univar's operations.

6.2 Chemicals Identified by the City of Portland

The City of Portland has identified metals, VOCs, SVOCs, phthalates, polychlorinated biphenyls (PCBs), pesticides, TPH, and total organic carbon (TOC) as COIs that have been discovered downgradient of the Univar property in stormwater conveyance pipes and/or in Willamette River Outfall No. 18 sediments (BES, 2006b). These chemicals, except for TPH and TOC, are included in the list of screening chemicals in the DEQ SPI guidance (DEQ, 2009). All of the chemicals and parameters identified by the City of Portland will be retained as COIs for the SPI since they are all directly related to stormwater quality at Outfall No. 18 and the City, DEQ and EPA have required that they be included.

It is important to note that the drainage system and river sediments receive runoff from numerous industrial sources and the chemicals detected in those sediments cannot be assumed to have originated from the Univar property.

6.3 Chemicals Identified by EPA

EPA has identified metals, SVOCs including phthalates and PAHs, chlorinated pesticides, chlorinated herbicides, polychlorinated dibenzo-p-dioxans and furans (PCDDs and PCDFs), TPH, and PCBs as COIs for Portland Harbor (EPA 2008). EPA has recommended that Univar analyze samples of both stormwater and sediment for these Portland Harbor COIs, with the exception of PCDDs and PCDFs in sediment samples only. Furthermore, EPA has recommended that Univar analyze for the following additional parameters:

- TOC and grain size in sediment samples only; and
- TSS and pH in stormwater samples.

These chemicals, except for TPH, TOC, TSS, and pH are included in the list of screening chemicals in the DEQ SPI guidance (DEQ, 2009). All of the chemicals and parameters identified by EPA will be retained for the SPI since they are all related to stormwater quality in the Portland Harbor. As described above, it is important to note that the drainage system and river sediments receive runoff from numerous industrial sources and the chemicals detected in those sediments cannot be assumed to have originated from the Univar property.

6.4 Summary of Retained COIs

Only those chemicals listed in the DEQ SPI guidance for evaluating the stormwater pathway at upland sites (DEQ, 2009), related to historical operations and cleanup, and identified by COP (BES, 2006b) and EPA (EPA, 2008, 2009) will be retained as COIs in the SPI Work Plan. Based on the potential sources described in Sections 6.1 through 6.3, the following COIs are retained:

- Metals listed in Appendix D of the DEQ SPI guidance (DEQ, 2009) including: aluminum (Al), antimony (Sb), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), and zinc (Zn);
- Additional metals identified by COP (BES, 2006b) and EPA (EPA, 2009) including iron (Fe) and molybdenum (Mo);
- Selected PCB Congeners reported on the EPA Method 8082 list;
- The standard suite of organochlorine pesticides reported on the 8081A list;
- The standard suite of chlorinated herbicides reported on the 8151A list;
- The standard suite of VOCs reported on the EPA Method 8260b list;
- The standard suite of SVOCs reported on the EPA Method 8270C list;
- Cyanide in stormwater (total, amenable, and free);
- Oil and Grease in stormwater only;
- TPH;
- Sulfides, Sulfate, and Ammonia (as nitrogen) as identified by COP (BES, 2006b) and EPA (EPA, 2009);
- TSS in stormwater;
- TOC;
- Grainsize analysis in sediment ; and
- pH in stormwater.

Table 10 includes the laboratory analytical methods. Table 11 includes laboratory reporting limits, and SLVs (DEQ, 2009). Chemicals and parameters which are known to be related to Univar's operations, property improvements, or RCRA cleanup actions are bolded and highlighted in Table 11.

6.5 Additional Chemicals of Interest

If additional chemicals are discovered to have the potential to impact stormwater discharge from the Univar property, these chemicals will be added to the list of COIs.

7.0 PRE-SAMPLING ACTIVITIES

The primary focus of the pre-sampling activities will be to prepare the City owned and operated 42-inch storm sewer main for sampling, evaluate the current condition of the storm sewer main, and evaluate the potential for groundwater infiltration to be contributing flow and/or contaminants to the sewer main.

7.1 Upstream Manhole Access

In order to provide access to the 42 inch storm sewer main immediate upstream of the Univar property, Univar plans to negotiate an access agreement with the adjacent property owner, Wilhelm Trucking, so that a manhole on their property may be used to achieve the scope defined in this work plan. The location of this manhole is shown in Figure 3, and is identified as SPI Sampling Point #1. The city will be contacted to obtain access and permits prior to conducting work in this manhole.

7.2 Clean 42-Inch Storm Sewer Main

This task includes cleaning the 42-inch storm sewer main prior to conducting the stormwater and in-line sediment sampling during the 2010/2011 rainy season. Cleaning activities will be conducted consistent with the procedures and notification requirements presented in DEQ's fact sheet entitled *Characterizing and Managing Catch Basin and In-line Sediments in Portland Harbor* and include:

- Contacting the City of Portland to obtain access to the sewer main prior to beginning line cleaning activities;
- Collection and sampling of both wastewater and sediments removed from the sewer. Wastewater and sediments will be sampled and analyzed for the suite of parameters described in Section 8.3 and Section 8.4 of this work plan, respectively;
- Characterization and disposal of the wastewater and sediments consistent with local, state, and federal regulations. Depending on the analytical results, the wastewater will either be discharged to the sanitary sewer under the facilities existing permit or a batch discharge permit, or disposed of offsite at an approved facility. Sediments will be dewatered, placed in an appropriately sized container (e.g., drums, roll-off), and transported offsite to an approved disposal facility.

7.3 Video Inspection of 42 Inch Storm Sewer Main

Once the 42 inch storm sewer main has been cleaned, a video inspection of the main will be conducted. The purpose of the video inspection will be to:

- Confirm the location and size of known side connections to the main, both from the Univar property and neighboring properties;
- Determine whether additional side connections exist that have not been previously identified;

- Document the general condition of the main including areas of disrepair; and
- Document areas of potential groundwater infiltration for further evaluation.

The initial video inspection will be conducted during a dry period in the summer months to evaluate base flows in any of the side connections or in the main itself. A separate video inspection will be conducted during the spring as part of the groundwater to stormwater pathway investigation described below.

7.4 Groundwater to Stormwater Pathway Investigation

The groundwater to stormwater pathway will be investigated by comparing groundwater elevations relative to stormwater conveyance piping elevations. The areas of investigation will include the following:

- The City owned and operated 42-inch storm sewer main located within the easement on Univar's eastern property boundary; and
- The Oregon Department of Transportation (ODOT) owned and maintained storm sewer main located north of Univar in the NW Yeon Avenue frontage road.

Seasonal high shallow groundwater elevations will be plotted relative to pipe elevations to define areas of potential groundwater infiltration. Pending permission from the City of Portland, these areas will be video inspected during periods of high shallow groundwater elevations (i.e., typically April or May) to document potential evidence of actual groundwater infiltration.

Since the location(s), if any, and site conditions of potential groundwater infiltration are not known at this time, Univar is not able to prepare a focused sampling and analytical plan for groundwater infiltration sampling. Therefore, if groundwater infiltration is observed, a supplemental work plan will be prepared and submitted to EPA, DEQ, and COP for review prior to performing additional work.

8.0 SAMPLING AND ANALYSIS PLAN

The overall field procedures will be performed consistent with previously approved sampling and analysis/quality assurance project plans (HLA, 1989; ITC, 2001). As requested by EPA, the SPI Work Plan also follows the general techniques and procedures listed in *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling* (Portland Harbor RI/FS; Anchor/Integral, 2007). Equipment and materials used in the work are provided in Table 12, which is consistent with the equipment and materials listed in previously approved plans (Table 1; ITC 2001) and those listed in the Portland Harbor RI/FS.

8.1 <u>Sampling Needs and Objectives</u>

This sampling plan includes procedures for collecting composite whole water samples and composite sediment trap samples from the City owned, operated, and maintained 42-inch diameter storm sewer main. Samples will be collected from the point of entry to the property (i.e., sampling point SPI-1) and the point of exit from the property (i.e., sampling point SPI-2) as shown on Figure 3. Specific sampling objectives are as follows:

- Collect composite whole water samples from sampling points SPI-1 and SPI-2 during the 2010/2011 storm season to assess the quality of stormwater entering and leaving the portion of the 42-inch storm sewer main adjacent to the Univar property. Water samples will be collected during three representative storm events using automatic samplers which are deployed throughout the entire storm season (i.e., October 31 through April 30);

- Collect composite inline sediment trap samples from sampling points SPI-1 and SPI-2 during the 2010/2011 storm season to provide additional information regarding the quality of stormwater (i.e., solids contribution) entering and leaving the property. Sediment traps will be deployed throughout the entire storm season (i.e., October 31 through April 30);

- Conduct continuous flow monitoring at sampling point SPI-1 and SPI-2 during the 2010/2011 storm season. The automatic stormwater samplers will be outfitted with continuous flow monitoring devices; and

- Collect composite sediment and wastewater samples generated during stormwater conveyance line cleaning.

8.2 Sample Designation

Samples will be prefixed with the sampling point number (i.e., SPI-1 and SPI-2).

- Sediment samples will be labeled with the sampling point number, the sampling media ("S" for sediment), and the sampling date. For example SPI-1-S-110109 will represent sediment sample collected from sampling point number SP-1 on November 1, 2009.

- Stormwater samples will be labeled with the sampling point number, the sampling media ("W" for water), and the sampling date. For example SPI-1-W-110109 will represent sediment sample collected from sampling point number SP-1 on November 1, 2009.

- Sediment samples collected during cleaning of storm conveyance piping will be labeled "CL", the sampling media ("S" for sediment), and the sampling date. For example CL-S-101509 will represent a sediment sample collected from line cleaning solids on October 15, 2009.

- Wastewater samples collected during cleaning of storm conveyance piping will be labeled "CL", the sampling media ("WW" for wastewater), and the sampling date. For example CL-WW-101509 will represent a wastewater sample collected from line cleaning activities on October 15, 2009.

8.3 Stormwater Sampling

Stormwater sampling will consist of collecting flow-weighted composite whole water samples from three storm events to obtain mean concentrations of chemicals. Flow-weighted, whole water (unfiltered) sample aliquots will be collected over the course each storm event using Isco 6712 automatic samplers. The automatic samplers will be deployed for the entire 2010/2011 storm season from October 31, 2009 through April 30, 2010, and samples will be collected as described in Appendix B. Samples will be submitted to the laboratory following each sampled storm event so that the samples may be analyzed within acceptable holding times. Samples will analyzed by Columbia Analytical Services (CAS) in Kelso, Washington.

8.3.1 Sample Locations

Stormwater samples will be collected from sampling points SPI-1 and SPI-2 (see Figure 3) located at the point of entry to the property and the point of exit from the property, respectively.

8.3.2 Sampling Frequency and Objectives

Sampling of composite water samples will be attempted during storms that meet the acceptable target storm conditions to obtain three (3) stormwater samples within the 2010/2011 wet weather season. Consistent with the Portland Harbor RI/FS (Anchor/Integral, 2007), the target storm conditions for sampling are:

- Antecedent conditions of less than 0.1 inches of rain in 24 hrs; and
- Predicted storm event total of greater than 0.2 inches over an expected storm duration of 3 hrs or more, not to exceed approximately 2.25 inches in a 24 hour period.

The objective is to collect composite samples that represent the water quality over the entire storm hydrograph. National Oceanic and Atmospheric Administration (NOAA; http://www.wrh.noaa.gov/forecasts/graphical/sectors/pqrWeek.php#tabs) and Oregon Climate Service (OCS; http://www.ocs.oregonstate.edu/index.html) storm forecasts will generally be used in the evaluation and identification of storms potentially meeting these criteria.

The described target storm conditions are considered goals. Each sampling event will be evaluated relative to these goals but circumstances may arise where all these goals cannot be met. In that event, EPA will be contacted to discuss sampling or storm conditions that fall substantially outside of the target storm conditions prior to analyzing the samples.

8.3.3 Sample Analysis

Stormwater samples will be analyzed by Columbia Analytical Services (CAS) in Kelso, Washington for the following parameters, as shown on Table 10. In the event that insufficient sample volume is collected to conduct all of the analyses, the sample analyses will be prioritized in the order listed below:

- Total suspended solids (TSS) by EPA Method 160.2;
- Total organic carbon (TOC) by EPA Method 415.1;
- Total metals by EPA Methods 200.8 and 1631M. The specific metals to be analyzed include the Al, Sb, As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Zn, and Mo;
- Dissolved Fe by EPA Method 200.7;
- VOCs by EPA Method 8260b;
- SVOCs by EPA Method 8270C with PAHs by EPA Method 8270C select ion monitoring (SIM);
- PCB Congeners by EPA Method 8082;
- Chlorinated Herbicides by EPA Method 8151A;
- Organochlorine Pesticides by EPA Method 8081A;
- Cyanide by EPA Methods 335.4 (total), 9014 (free), and 335.1 (amenable);
- Oil and grease (hexane extractable materials [HEM]) by EPA Method 1664;

- TPH – diesel and residual range organics by Northwest TPH Method NWTPH-Dx;
- Sulfides by EPA Method 9030b;
- Sulfate by EPA Method 300/9036; and
- Ammonia as nitrogen by EPA Method 350.1.

Field measurements of water quality characteristics will be taken at all sampling locations including conductivity, pH, temperature, and turbidity. Procedures for the field measurements are specified in Section 8.3.7.

8.3.4 Field Records

A description of the sampling information will be recorded on a stormwater sampling form for each sampled storm event. Sampling information recorded on the form will include the following:

- Estimated start and end time of rainfall event;
- Date and time of sampling;
- Sampling location;
- Names of sampling team members;
- Collected sample volume and sampling rate;
- Parameters to be analyzed;
- Field parameter measurements: conductivity, pH, turbidity, and temperature;
- Observed flow rate, water depth, and volume at time of sample retrieval;
- Record weather conditions at the time of sample retrieval and visual observations of stormwater flow: sheen, odor, color, and floatables; and
- Unusual circumstances.

8.3.5 Automatic Sampler Programming and Deployment

The automatic samplers will be programmed and deployed per the procedures listed in Appendix B and C. The samplers will initially be setup with four programs to cover design storm events from 0.2 inches to 0.5 inches, 0.5 inches to 1.0 inches, 1.0 inches to 1.5 inches, and 1.5 inches to 2.25 inches. These ranges of storm intensity along with drainage basin area and runoff characteristics will be used to estimate discharge volumes for each of the design storm ranges. Based on the range of estimated discharge volumes, samplers will be programmed to collect aliquots of stormwater in a uniform paced variable-volume manner. The automatic samplers will be programmed to begin collecting stormwater after stormwater flow and/or depth conditions meet predetermined levels.

The objective of the programming is to collect a flow proportional composite sample that represents the entire storm hydrograph (aliquots will be collected into eight 1.8 liter bottles over the storm event). The sampler will be programmed to collect a 10 milliliter (ml) aliquot for each unit volume of water that passes the flow meter. The unit volume of water passing the flow meter will be proportional to the expected volume of each design storm. The sampler will be programmed to collect aliquots on a uniform time basis. The number of aliquots collected will be dependent on the number of unit volumes of water that pass the flow meter in the time interval. The sampler will be programmed to collect a total sample volume between the minimum required for laboratory analysis and the maximum holding capacity of the automatic sampler for each of the design storms.

The minimum and maximum storm volumes will be calculated using the Santa Barbara Urban Hydrograph method as described in the City of Portland's *Stormwater Management Manual* (COP, 2008) for the four design storm events ranges (listed above). For each range of storms, a design storm flow will be selected from near the middle the calculated range of storm flows, and this design storm flow will be used to estimate the design unit volume of water for the sampling program. This approach will increase the likelihood that an acceptable minimum sample volume is collected and that the sample bottles are not filled before the end of the storm. If too little sample volume is collected, although it is a representative composite sample, there may not be enough volume for all analyses. If the sample bottles are filled before the end of the storm, the composite sample may not be representative of the entire flow period (i.e., sample may not include the falling limb of the storm). This programming approach is only a guideline, and may be modified if site conditions differ significantly from the pre-sampling design conditions.

8.3.6 Stormwater Sampling Procedures

After the stormwater samplers are programmed and deployed, the samplers will be in standby waiting for one of the four sampling programs to be enabled. The sampling team will review weather forecasts for antecedent weather conditions and prediction of storm events meeting target criteria (Section 8.3.2). When a target storm is predicted, the automatic samplers will be enabled and samples collected per the procedures listed in Appendix B. These procedures follow the general techniques and procedures listed in the Portland Harbor RI/FS (Anchor/Integral, 2007). Table 12 presents a list of equipment to be used for all of the sampling activities.

Following each sampled storm event, the automatic sampler will be retrieved and field sampling data will be reviewed to determine if the collected water meets the criteria for acceptable stormwater sampling conditions. As described in Appendix B, the samples will be checked to determine if there is adequate volume for analysis, the rainfall and antecedent conditions will be reviewed to verify that target storm conditions have been met, and storm flow hydrograph will be reviewed to determine which sample containers should be composited. If acceptable conditions exist, the water will be composited and submitted for laboratory analysis. If it appears that samples may not be reasonably representative of the storm or the target storm conditions and the issue cannot be resolved by using one of the contingency measures described in Appendix B, the representativeness of the sample containers selected for compositing will be discussed with EPA prior to submittal to the laboratory.

Refer to Section 8.7 for phthalate considerations.

8.3.7 Stormwater Flow Measurements

Isco Model 750 Area Velocity flow modules will be used in conjunction with the Isco automatic samplers to allow the collection of flow-weighted composites at each sampling location as described in Appendix C. The flow modules will also continuously record flow data for the entire 2010/2011 storm season. The flow monitoring data will be downloaded following sampling events or maintenance checks. As described above, the data will be used to determine the acceptability of stormwater samples. The flow data will also be used to monitor base flows of non-stormwater.

8.3.8 Stormwater Field Parameter Measurements

Stormwater field parameter samples will be collected using hand collection techniques at the time of composite stormwater sample retrieval. Field parameters include conductivity, pH, temperature, and turbidity. Table 12 presents a list of equipment to be used for all of the sampling activities. A summary of the surface water sampling procedures is listed below.

1. Collect a single grab sample from the stormwater conveyance line using either a clean plastic container attached to a sampling pole or a peristaltic pump with suction tubing.

2. If using a sampling pole, dip the bottle into the flowing water in the manhole (facing upstream), and fill with the stormwater flowing through stormwater conveyance pipe.

3. If using a peristaltic pump with suction tubing, lower the suction tubing into the flowing water and pump stormwater into the plastic bottle.

4. Transfer sample water into a plastic cup for measurement of conductivity, temperature, and pH (with a pH meter or pH paper); and to a glass sample vial for measurement of turbidity. Upon completion of the field measurements, the sample water will be discarded back into the storm drain.

5. Record visual observations of the stormwater including color, floatables, foam, and sheen.

8.3.9 Stormwater Sampling Procedure Alterations

Any deviations from the general sampling procedures presented here will be documented and brought to the attention of the PES project manager. As stated in Section 10, major deviations will be brought to the attention of EPA and all deviations will be included in quarterly progress reports.

8.3.10 Storm Event Documentation

A field report will be recorded for each sampled storm event. The field report will include the information described in Section 8.3.4, field monitoring parameters described in Section 8.3.8, volume of the collected sample, list of collection containers selected for sample compositing, chain of custody, copy of runoff calculations and trigger flow or level, and a copy of the storm flow hydrograph (from the automatic sampler data logger) showing discrete sample collection intervals.

In accordance with the DEQ SPI guidance (DEQ, 2009) the field report will also include a rainfall distribution graph that begins 24 hours prior to the storm event with an indication of when the sampling took place. Rainfall data will be gathered from the nearest City of Portland rain gage: Yeon rain gage located at 3395 NW Yeon Avenue. The City of Portland rain gages measure hourly rainfall data. Data from the rain gage is available on the following website: http://or.water.usgs.gov/non-usgs/bes/.

8.4 Sediment Trap Sampling

Sediment sampling will consist of deploying a sediment trap at each sampling location for the entire 2010/2011 storm season from October 31, 2009 through April 30, 2010. Appendix D describes the methods of sediment trap deployment, and sample collection and compositing. Composite samples will be submitted to Columbia Analytical Services (CAS) in Kelso, Washington for analysis at the end of the storm season.

8.4.1 Sample Locations

Sediment samples will be collected from sampling points SPI-1 and SPI-2 (see Figure 3) located at the point of entry to the property and the point of exit from the property, respectively.

8.4.2 Sampling Frequency and Objectives

Sediment traps will be checked at a minimum monthly frequency. When inspected, if the collection bottle is half full, sediments will be collected and archived and a clean bottle will be returned to the trap. This process will be repeated, and sampled sediments stored frozen for later compositing until the trap deployment period ends. The objective of this sampling strategy is to collect samples of stormwater solids that may be representative of the entire storm season.

Sediment generation rate will varies by land use, topography, implementation of best management practices (BMPs), and rainfall intensity. A well swept, nearly level, industrial area may not generate a significant quantity of sediment. Low intensity storms may not detach and mobilize sediments. Further, sediment traps may not collect sediments from low flow storm events. Therefore, if the collection bottle is less than one-third full at the first monthly inspection, the rainfall records will be evaluated to determine if there were storms likely to generate runoff, the sampler will be inspected to ensure that it was installed properly, the junction will be inspected to see if it is accumulating sediment, and the contributing basin will be visually surveyed to see if sediment is available to wash off. Based on the findings, it may be recommended that the sediment trap be repositioned or relocated to obtain better collection rate or additional bottles deployed.

8.4.3 Sample Analysis

Sediment samples will be analyzed by Columbia Analytical Services (CAS) in Kelso, Washington for the following parameters as shown on Table 10. In the event that insufficient sample volume is collected to conduct all of the analyses, the sample analyses will be prioritized in the following order:

- PCB Congeners by EPA Method 8082;
- Organochlorine Pesticides by EPA Method 8081A;
- Total metals by EPA Method 6010/6020 and EPA Method 7471. The specific metals analyzed include the Al, Sb, As, Cd, Cr, Cu, Pb, Mn, Hg, Ni, Se, Ag, Zn, Fe, and Mo;
- SVOCs by EPA Method 8270C;
- Chlorinated Herbicides by EPA Method 8151A;
- Dioxins and Furans by EPA Method 1613b;
- VOCs by EPA Method 8260b;
- TPH – diesel and residual range organics by Ecology Method NWTPH-Dx;
- Total organic carbon (TOC) by Plumb 1981 Method;
- Percent solids and grain size by Puget Sound Estuary Program (PSEP) 1986 Method;
- Sulfides by EPA Method 9030b;
- Sulfate by EPA Method 300.0M/9056; and
- Ammonia as nitrogen by EPA Method 350.1M.

The order of sediment sample analysis has been prioritized based on comments from COP (BES, 2008b), comments on the draft SPI Work Plan from EPA (EPA 2008, and the priority listed in Table 2-3 of Lower Willamette Group (LWG) Round 3A Field Sampling Plan (Anchor/Integral 2007). COP recommended that PCBs, pesticides, and SVOCs be the first priority for analyzing sediment samples. Therefore, analysis of these chemicals has been placed at the top of the priority list. EPA identified metals, SVOCs, phthalates, chlorinated pesticides, chlorinated herbicides, polychlorinated dibenzo-p-dioxins and furans, TPH, PAHs, and PCBs (in this order) as Portland Harbor contaminants of interest. Since chlorinated pesticides and dioxins and furans were not included in the draft SPI Work Plan, analysis of these chemicals have been included as the next highest priority. Analysis of VOCs has been selected as the next priority because VOCs are the focus for cleanup actions on the property; and analysis of TPH has been listed next, because TPH has been detected in soil samples in the eastern driveway. Analysis of TOC, percent solids, and grain size have been identified as the next analysis priority based on the priority order listed in Table 2-3 of the LWG sampling plan. The sampling plan listed sediment analyses in this order: PCB congeners, TOC, percent solids, organochlorine pesticides, PAHs and phthalates, metals, herbicides, and grain size. Finally, analysis of sulfides, sulfate, and ammonia as nitrogen has been given the lowest priority of analysis. As described in Section 6.1.5, as these chemicals are associated with the permitted industrial wastewater discharge permit from Univar's neutralization area, there almost no potential for industrial waste water to enter the storm sewer system because the neutralization area is directly plumbed to the sanitary sewer.

8.4.4 Field Records

A description of the sampling information will be recorded on a sediment trap sampling form. Sampling information recorded on the form will include the following:

- Date and time of sampling;
- Sampling location;
- Names of sampling team;
- Record weather conditions at the time of sampling;
- Note the presence of water, visible flows, clogging, debris in or around the sample bottle, staining, etc.;
- When recovering samples, record visual observations of:
    - Color;
    - Texture, estimates of particle size fractions (as soil classification); and
    - Amount and type of debris (Note: any large debris observed in the sample, miscellaneous pieces of plastic and metal, stones and gravel, etc., should be removed, but paint chips and small organic matter should be left in the sample).
- Record visual observations of stormwater flow: sheen, odor, color, floatables; and
- Unusual circumstances.

8.4.5 Sediment Sampling Procedures

Sediment traps will be deployed and samples will be collected per the procedures listed in Appendix D. These procedures follow the general techniques and procedures listed in the Portland Harbor RI/FS (Anchor/Integral, 2007). Table 12 presents a list of equipment to be used for all of the sampling activities.

Sediment traps will generally be installed at each sampling location as close to the manhole as possible and downstream of the automatic sampler intake tube, but this may vary depending on field conditions. Sediment traps will be installed on the bottom of the stormwater conveyance pipe, and are expected to require the use of sand bags or structural modifications to generate flow conditions conducive to sediment trap sampling.

Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is more than half full of sediments, the bottle will be capped, removed from the mounting brackets, packaged and placed on ice in coolers for transport, and archived. A clean empty collection bottle will then be placed in the trap. If the collection bottle is less than one third full at the first monthly inspection, options for repositioning or relocating the equipment or adding additional traps to obtain a higher collection rate will be considered. Due to physical constraints, it may not be possible to position or deploy enough sediment traps such that sufficient sample volume is obtained during the storm season.

At the end of the sediment trap deployment period, all sampled sediments (including archived aliquots, which have been allowed to thaw in the refrigerator) will be combined, thoroughly homogenized, and distributed to sample jars for laboratory analysis. Refer to Section 8.7 for phthalate considerations. Samples will be composited per the procedures listed in Appendix D.

8.4.6 Sediment Sampling Procedure Alterations

Any deviations from the general sampling procedures presented here will be documented and brought to the attention of the PES project manager. As stated in Section 10, major deviations will be brought to the attention of EPA and all deviations will be included in quarterly progress reports.

8.5 Stormwater Conveyance Line Cleaning Solids and Wastewater Sampling

As described in Section 7.2, solids and wastewater generated during stormwater conveyance line cleaning will be composited and sampled for the parameters listed in Section 8.4.3 and 8.3.3, respectively. Samples will be handled using techniques consistent with sediment trap sampling as described in Appendix D and the stormwater sampling techniques described in Appendix B.

8.6 Sample Labeling, Shipping, and Chain-of-Custody

All environmental samples collected during the project will be labeled, stored and shipped using the protocols summarized below.

8.6.1 Sample Labeling

Sample container labels will be completed immediately before or immediately following sample collection. Container labels will include the following information:

- Project name;
- Sample number;
- Initials of collector;
- Date and time of collection; and
- Analysis requested.

8.6.2 Sample Transportation

Stormwater samples will be transported to the designated laboratory using the following procedures:

- Sample containers will be transported in a cooler or other suitable shipping container;
- Ice or "blue ice" will be placed into each shipping container with the samples;
- All sample shipments will be accompanied by a chain-of-custody form. The completed form will be sealed in a plastic bag; and
- The name and address of the analytical laboratory will be placed on each shipping container prior to transportation.

8.6.3 Chain-Of-Custody

Once a sample is collected, it will remain in the custody of the sampler or other environmental contractor personnel until shipment to the laboratory. Upon transfer of sample possession to subsequent custodians, a chain-of-custody form will be signed by the persons transferring custody of the sample container. Upon receipt of samples at the laboratory, the receiver will record the condition of the samples. Chain-of-custody records will be included in the analytical report prepared by the laboratory.

8.6.4 Sample Log-in

Upon receipt of samples (which will be accompanied by a completed chain-of-custody record detailing requested analyses), the laboratory coordinator(s) or his/her delegate will:

- Verify all paperwork, chain-of-custody records, and similar documentation;

- Log-in samples, assign unique laboratory sample numbers, and attach the numbers to the sample container(s);
- Open project file and enter data into the file;
- Store samples in a refrigerated sample bank; and
- Fax a record of the sample receipt and log-in form to the PES project manager noting any problems with the samples.

8.7 Decontamination and Residuals Management

A sample collection pole will be used to lower and hold the sample bottles to the sample collection point for measuring field parameters. The sample collection pole will not come into contact at any time with the interior of the sample bottle. At the completion of a sampling event, the sample collection pole will be wiped down with a moist towel and allowed to air dry.

Decontamination during stormwater sampling, sediment trap sampling, and flow monitoring will be performed as described in Appendixes B and D.

Disposable sampling gloves will be used during sampling activities and will be disposed of in the garbage after use. It is not anticipated that any other residuals will be generated during sampling activities.

The following decontamination methods will be followed assuming that phthalates may be present at any sampling location.

1. During all decontamination procedures, equipment will be handled with powder and phthalate-free vinyl gloves and will not be placed on any plastic or rubber surfaces (decontaminated stainless steel surfaces are preferred);
2. Sample bottles will not be placed on any plastic or rubber surfaces during sample processing (decontaminated stainless steel surfaces are preferred); and
3. Once the sample bottles are filled after sample processing, they will be capped with Teflon® lids and placed in phthalate free containers before placing in coolers for transport.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Sample quality assurance (QA) and quality control (QC) measures are undertaken to ensure that the data collected during the project are acceptable for their intended use(s).

9.1 Quality Assurance Objectives

The overall quality assurance (QA) objective for measurement data is to ensure providing data of known and acceptable quality. All measurements will be made to yield accurate and precise results representative of the media and conditions measured. Chemical analyses will be performed in accordance with the requirements of the analytical methods. All sample results will be calculated and reported in consistent units to allow comparison of the sample data with regulatory criteria and federal, state, and local databases. QA objectives for precision, accuracy, and completeness have been established for each measurement variable. The laboratory quality control (QC) program is consistent with the previously approved SAP/QAPP QC program (ITC, 2001). The work elements relative to the approved SAP/QAPP are listed in Table 13. The type of QC samples and the frequency of collection or analysis are discussed below and in Table 14. The control limits and are presented in Table 15. Reporting limits (RLs) are specified in Table 11, and laboratory deliverables are presented in Table 16.

The following work elements to support the planned activities are subject to the quality assurance project plan (QAPP):

- Stormwater whole water sample collection for laboratory analysis;
- Sediment trap sample collection for laboratory analysis; and
- Laboratory analysis of sediment and water samples by the methods listed in Section 8.0.

9.2 Laboratory Methods

9.2.1 Conventional Analyses

Conventional analyses of stormwater samples will include TOC and total suspended solids (TSS). Lab methods, sample volumes, and holding times are shown in Table 10.

- TOC in stormwater samples will be analyzed according to EPA Method 415.1 (EPA, 2006); and
- TSS in stormwater samples will be analyzed according to EPA Method 160.2.

Conventional analyses of sediment samples will include total organic carbon (TOC), percent solids, and grain size distribution.

- TOC in sediment samples will be analyzed according to Plumb (1981); and

- Percent solids in sediment samples will be determined according to PSEP (1986). These results will be used to calculate analyte concentrations on a dry-weight basis. Grain size analysis will also be completed using PSEP (1986) protocols. Organic material in the samples will not be oxidized prior to analysis. Sieve sizes 4, 10, 18, 35, 60, 120, and 230 will be used to determine gravel and sand fractions, and phi size intervals 4-5, 5-6, 6-7, 7-8, 8-9, 9-10, and >10 will be determined for the silt and clay fractions using the pipette method.

9.2.2 Chemical Analyses

The following chemical analyses will be performed on stormwater and sediment samples as shown in Table 10. Chemical analyses will be performed on both stormwater and sediment samples unless otherwise noted.

- **<u>Metals.</u>** Metals stormwater samples will be analyzed according to EPA Method 200.7 for Fe; EPA Method 200.8 for Al, Sb, As, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn, and Mo; and EPA Method 1631M for Hg. Mercury will be analyzed using EPA Method 1631M. Metals in sediment samples will be analyzed according to EPA 6000/7000 series methods for Al, Sb, As, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn, Hg, Fe, and Mo.

- **<u>PCB congeners.</u>** PCB congeners will be analyzed according to EPA Method 8082;

- **<u>Organochlorine pesticides.</u>** Organochlorine pesticides will be analyzed according to EPA Method 8081. Both the standard and NOAA analyte lists will be reported.

- **<u>Chlorinated herbicides.</u>** Chlorinated herbicides will be analyzed according to EPA Method 8151A.

- **<u>SVOCs.</u>** SVOCs will be analyzed by EPA Method 8270C. PAH analytes in water samples will be analyzed by EPA Method 8270C select ion monitoring (SIM) to achieve low level reporting limits.

- **<u>Dioxins and furans.</u>** Dioxins and furans in sediment samples will be analyzed by EPA Method 1613b. Dioxins and furans will not be analyzed in stormwater.

- **<u>VOCs.</u>** VOCs will be analyzed by EPA Method 8260b.

- **<u>TPH.</u>** TPH will be analyzed for diesel and oil range organics by Ecology Method NWTPH-Dx.

- **<u>Oil and Grease.</u>** Oil and Grease in stormwater samples will be analyzed by EPA Method 1664 for hexane extractable materials (HEM). Oil and grease will not be analyzed in sediment samples.

- **<u>Cyanide.</u>** Cyanide will in stormwater samples will be analyzed by EPA Method 335.4 (total cyanide), EPA Method 9014 (free cyanide), and EPA Method 335.1 (amenable cyanide). Cyanide will not be analyzed in sediment.

- **<u>Sulfides.</u>** Sulfides will be analyzed by EPA Method 9030b.

- **<u>Sulfate.</u>** Sulfate in stormwater will be analyzed by EPA Method 300/9056. Sulfate in sediments will be analyzed by EPA Method 300M/9056.

- **<u>Ammonia as Nitrogen.</u>** Ammonia as nitrogen in stormwater will be analyzed by EPA Method 350.1. Ammonia in nitrogen in sediments will be analyzed by EPA Method 350.1M.

9.2.3 Field Parameters

Field measurements of water quality characteristics will be taken at all sampling locations including conductivity, pH, temperature, and turbidity.

9.3 <u>Data Reduction, Validation, and Reporting</u>

The laboratory performing sample analyses will be required to submit summary data and QA information to permit independent and conclusive determination of data quality. The determination of data quality will be performed using EPA as guidelines for data review (EPA 1999, 2004). Section 9.4 describes the procedures that will be used to evaluate the precision, accuracy, and completeness of the analytical test data. Upon completion of the data review, the QA reviewer will be responsible for developing a data validation memorandum for the lab data.

9.3.1 Laboratory Reporting

Consistent with the previously approved SAP/QAPP (ITC, 2001), the laboratory performing sample analyses will be required to submit summary data and QA information to permit independent determination of data quality. The determination of data quality will be performed using the EPA Contract Laboratory Program National Functional Guidelines for organic and inorganic data review as guidelines for data review.

An EPA Level II or equivalent data report will be obtained from the analytical laboratory. Laboratory deliverable requirements for lab analyses are outlined below and included in Table 16. This table was duplicated from the 2001 SAP/QAPP with slight modification.

- Narrative cover letters for each sample batch will include a summary of any QC, sample, shipment, or analytical problems, and will document all internal decisions. Problems will be outlined and final solutions documented. A copy of the signed chain-of-custody form for each batch of samples will be included in the results packet;

- Sample concentrations will be reported on standard data sheets in proper units and to the appropriate number of significant figures. For undetected values, the lower limit of detection for each compound will be reported separately for each sample. Dates of sample extraction or preparation and analysis must be included;

- A method blank summary;

- Surrogate percent recovery will be calculated and reported for GC and GC/MS analyses;
- LCS results;
- MS/MSD percent recoveries, spike level, and relative percent difference will be included;
- Laboratory duplicate results; and
- Laboratory reports will be e-mailed to the PES project manager. Copies of the full data set and electronic data deliverables formatted per PES requirements will also be transmitted to the PES project manager.

9.3.2 Field Measurement Data

The project manager will check the validity of all field data on a periodic basis by reviewing calibration procedures utilized in the field and by comparing the data to previous measurements obtained at the specific site.

9.3.3 Final Reporting and Archiving of Documents

Copies of all analytical data and/or final reports will be retained in the laboratory files. After one year, or whenever the data becomes inactive, the files will be transferred to archives in accordance with standard laboratory procedure. Data may be retrieved from archives upon request.

9.4 Data Assessment Procedures

Accuracy, precision, completeness, representativeness, and comparability are terms used to describe the quality of analytical data. Routine procedures for measuring precision and accuracy include use of replicate analyses, standard reference materials (SRMs), matrix spikes, and procedural blanks. Replicate matrix spikes and method blanks will be analyzed by the selected laboratory for the analytical batch. Additional spikes and replicate analyses may be implemented. The minimum frequencies are as follows:

- Matrix Spike
  - One matrix spike and laboratory control sample or one matrix spike/matrix spike duplicate will be analyzed per sample batch (no more than 20 samples per batch)
- Method Blank
  - One preparation blank will be analyzed per 12-hour shift.

Quality of analytical data represented by precision and accuracy are calculated using the mean, standard deviation, and percent recoveries. The mean, C, of a series of replicate measurements of concentration, C_i, for a given analyte will be calculated as:

$$\overline{C} = \frac{1}{n}\sum_{i=1}^{n} C_i$$

where:

n = Number of replicate measurements

The estimate of precision of a series of replicate measurements can be expressed as the relative standard deviation, RSD:

$$\text{RSD} = \frac{SD}{\overline{C}}\ X\ \ 100\%$$

where:

SD = Standard deviation:

$$SD = \frac{\sqrt{\sum_{i=1}^{n}(Ci - \overline{C})^2}}{(n-1)}$$

Alternatively, for data sets with a small number of points (e.g., duplicate measurements), the estimate of precision will be expressed as a relative percent difference (RPD):

$$RPD = \frac{C_1 - C_2}{\overline{C}}\ x\,100$$

where:

C_1 = First concentration value or recovery value measured for a variable

C_2 = Second concentration value or recovery value measured for a variable

Accuracy as measured by matrix spike or laboratory control sample results will be calculated as:

$$\text{Recovery} \ = \frac{\Delta C}{C_s}\ x\ 100$$

where:

ΔC = The measured concentration increase due to spiking (relative to the unspiked portion)

C_s = The known concentration increase in the spike

Acceptable spike recoveries and acceptable relative percent differences (RPDs) are indicated in the appropriate analytical methodology or provided by the laboratory(s) based on control-charted recoveries.

Accuracy can also be measured by analysis of standard reference material (SRM) or regional reference material and will be determined by comparing the measured value with the 95 percent confidence interval established for each analyte.

Completeness will be measured for each set of data received by dividing the number of valid measurements actually obtained by the number of valid measurements that were planned.

9.5 Field Quality Assurance

Field QA will be maintained through compliance with the SAP and documentation of sampling plan alterations. If problems arise during field sampling, a Sampling Alteration Checklist will be completed.

9.6 Corrective Action

Nonconforming items and activities are those, which do not meet the project requirements or approved work procedures. Non-conformances may be detected and identified by project staff or laboratory staff. The person identifying the nonconformance will be responsible for reporting it to the PES project manager and for its documentation.

- **Project Staff.** During the performance of field activities and testing and verification of laboratory testing results;

- **Laboratory Staff.** During the preparation for and performance of laboratory testing, calibration of equipment, and QC activities; and

- **QA Staff.** During the performance of audits.

Documentation will be made available to the PES project manager. Appropriate personnel will be notified by the management of any significant nonconformance detected by the project or laboratory staff. Completion of corrective actions for significant nonconformance will be verified by the PES project manager.

9.7 Files and Document Control

All records and files associated with the project will be maintained by PES in project files. Files will be maintained using standard PES file numbering protocols. Electronic files are stored on computer hard drives and backed up to compact disks on a routine schedule.

9.7.1 Record Control

Following receipt of information from external sources, completion of the field and laboratory phases of the project, and completion of analyses and issuance of reports or other transmittals, associated records will be submitted to the central project files. Field records; laboratory data summaries; test data; numerical calculations; reports and other data transmittals; copies of purchase orders for project services and contracts; correspondence including incoming and outgoing letters, memorandums, and telephone records; photographs; reference material; drawings; and CDs containing computer data and information will be transferred to the project central file. Records submitted to the project central file will be placed in folders or otherwise secured for filing.

9.7.2 Laboratory Files

The laboratory will maintain a records management system for documents pertinent to analytical performance. Laboratory records will include documents which are specific to the project, such as chain of custody, raw analytical data, and analytical reports, and documents which demonstrate overall laboratory operation, such as instrument log books and control charts.

9.7.3 Record Retention

Records will be stored for a minimum of three years after the termination of the order. For the project central file, the individual file folders will be divided into appropriate categories based on content, and numbered and filed sequentially within each category. For the original drawing and QA files, material will be filed only by project number. Computer files of laboratory data and other project information will be filed by project number and date.

10.0 REPORTING

The results of the investigation will be submitted in a report according to the approved CMI Implementation Schedule. The report will include a summary description of field activities and results, rainfall distribution graphs, data summary tables, data validation reports, and electronic copies of laboratory reports. Major deviations from this work plan will be brought to the attention of EPA, and all deviations will be included in quarterly progress reports.

11.0 LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

12.0 REFERENCES

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TABLES

Table 1

Bulk Tank List - May 2009 Inventory
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

TANK	Size (gals)	PRODUCT		TANK	Size (gals)	PRODUCT
TS1-01	28,946	Acetone		**TC1-51**	3,181	Texanol
TS1-02	28,946	Mineral Spirits Low Arom		**TC1-52**	3,181	Texanol
TS1-03	28,946	Acetone		**TC1-53**	3,181	Texanol
TS1-04	28,946	Toluene		**TC1-54**	8,000	Blend Tank
TS1-05	12,310	Arcosolv PM		**TC1-55**	5,949	Glycol Ether EB
TS1-06	12,310	Vanzol A-1 190		**TC1-56**	5,949	Lipotin 100
TS1-07	12,310	Heptane		**TC1-59**	12,000	Vesenex 80
TS1-08	12,310	Ethylene Glycol		**TC1-60**	7,677	Aqua Ammonia
TS1-09	12,310	DEG (MM/XL WHSE)		**TC1-61**	6,074	Nitric Acid
TS1-10	12,310	Woodlife 111		**TC1-62**	6,074	Nitric Acid
TS1-11	25,770	Ethylene Glycol		**TC1-63**	10,528	Sulfuric Acid
TS1-12	21,860	Woodlife 111		**TC1-65**	6,000	Water
TS1-13	20,571	DEG (MM/XL WHSE)		**TC1-66**	6,000	Aluminium Sulfate
TS1-13		DEG (Portland WHSE)		**TC1-67**	6,000	Propylene Gylcol
TS1-14	21,860	Xylene		**TC1-68**	12,831	Caustic Potash 45%
TS1-15	38,600	Empty		**TC1-69**	12,831	Caustic Potash 45%
TS1-16	38,600	Woodtreat MB RTU		**TC1-70**	12,000	Caustic 25%
TS1-17	10,575	Xylene		**TC1-71**	10,000	Water
TS1-18	10,575	Empty		**TC1-72**	10,600	Versenes 100
TS1-19	10,575	Empty		**TC1-73**	12,000	Empty
TS1-20	10,575	VM&P Naptha		**TC1-75**	4,000	Neutralization Water
TS1-21	10,575	Isopropyl Alcohol 85%		**TC1-76**	14,805	Versenex 80
TS1-22	10,575	Empty		**TC1-77**	14,805	Versenes 100
TS1-23	38,600	Triethylamine		**TC1-80**	8,000	Corrosive Blend Tank
TS1-24	38,600	Empty		**TC1-81**	1,100	Corrosive Blend Tank/Dry
TS1-25	38,600	Methanol		**TC1-82**	7,520	Caustic Soda 50%
TS1-26	38,600	Methanol		**TC1-83**	8,200	Hydrochloric Acid
TS1-44	5,949	Empty		**TC1-92**	10,000	Sodium Bisulfite 38%

Note:

a) Bulk tank contents listed are based on the inventory in May 2009. Depending on current customer demands, the amount of the listed product in a tank may vary (i.e., the tank may be only partially full) or the product stored in a given tank may have changed. Univar maintains a current inventory of the tank contents at the facility.

Table 2

Bulk Product List - May 2009 Inventory
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Bulk Products[a]	
Isopropyl Alcohol 99%	Lipotin 100
Mineral Spirits Low Aromatic	Caustic Soda 25%
Acetone	Aqua Ammonia
Toluene	Nitric Acid
Arcosolv PM (1-Methoxy-2-Propanol)	Sulfuric Acid
Vanzol A-1 190	Aluminum Sulfate
N Propyl Alcohol	Texanol
Woodlife	Propylene Glycol
Methanol	Caustic Potash 45%
Woodtreat MB RTU	Methylene Chloride
Solvent 2247	Trichloroethylene
Diethylene Glycol (DEG)	Versenex 80
DMK Refined w/12% Methanol	Caustic Soda 50%
Xylene	Hydrochloric Acid
Methyl Ethyl Ketone	Sodium Bisulfate
Isopropyl Alcohol 85%	Glycol Ether EP
Triethylamine	N Butyl Acetate
VM&P Naphtha	N Propyl Acetate
Heptane	Liquid Wax
Glycol Ether EB	Ethylene Glycol
Sodium Bisulfite	Versene 100

Note:
a) Bulk tank listed are based on the inventory in May 2009. Some products are transferred to bulk tanks (see Table 1), and others are repackaged in smaller volume containers. Univar maintains a current inventory of the tank contents at the facility.

Table 3

Drainage Basin List
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Drainage Area Number	Estimated Impervious Area (sq. ft.)	Description	Stormflow Connections to Storm Sewer[a]
1	94,100	Southern half of rail spur, drum fill area, and solvent tank farm area	Lateral from basin is directly connected to 42" main onsite.
2	107,300	Eastern portion of the site including east drive, covered storage structures, and the eastern half of the warehouse	1) 3 catch basins are directly connected to 42" main onsite. 2) 3 roof drains are directly connected to 42" main onsite. 3) 2 catch basins and 1 underground lateral pipe are directly connected to the 42" main from offsite.
3	65,900	Central portion of the site including corrosive tank farm and central rail spur	Lateral from basin is directly connected to 42" main onsite.
4	77,200	Southern portion of site including remediation building	1) 2 catch basins are directly connected to 42" main onsite. 2) 1 roof drain is directly connected to 42" main onsite. 3) 1 non-stormwater catch basin from remediation system[b] is directly connected to 42" main onsite. 4) 2 underground lateral pipes without a surface access are directly connected to the 42" main onsite. 5) 2 catch basins and 5 underground lateral pipes are directly connected to the 42" main from offsite.
5	35,300	North-western portion of site including rail spur, truck unloading, and employee parking.	1) Lateral from basin is directly connected to 8" main on American Steel property. 2) 1 underground lateral pipe without surface access is directly connected to the 42" main onsite.
6	40,200	Northern portion of the site mainly used for employee parking.	Lateral from basin is directly connected to 42" main onsite.

Note:

a) Stormflow connections are based on field observations, historical reports (BRI 2004, HLA 1996), and information obtained from City of Portland maps available online at http://www.portlandmaps.com.

b) The ICM groundwater treatment system discharges treated groundwater via catch basin CB-4D directly to the 42-inch stormwater main via NPDES Permit No. 101613.

Table 3

Drainage Basin List
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Drainage Area Number	Estimated Impervious Area (sq. ft.)	Description	Stormflow Connections to Storm Sewer[a]

Table 4

Historical Soil and Groundwater Sampling Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Highest Soil Concentration[a] (ug/kg)	Soil SLV[d] (ug/kg)	Groundwater Concentration		Groundwater SLV[d] (ug/L)
			Highest[b] (ug/L)	Adjacent[c] (ug/L)	
Benzene	840	**NA**	900	6.4	**1.2**
Chloroform	550	**NA**	22	< 0.5	**0.17**
1,1-Dichloroethane	18,000	**NA**	6,600	300	**47**
1,2-Dichloroethane	14,000	**NA**	16	1.0	**0.73**
1,1-Dichloroethene	13,000	**NA**	4,300	< 0.5	**NA**
cis-1,2-Dichloroethene	82,000	**NA**	56,000	31	**61**
trans-1,2-Dichloroethene	8,600	**NA**	360	1.2	**100**
Ethylbenzene	1,100,000	**NA**	12,000	0.8	**7.3**
Styrene	470,000	**NA**	1,000	< 0.5	**100**
Tetrachloroethene	14,000,000	**500**	52,000	6.4	**0.12**
Toluene	21,000,000	**NA**	260,000	7.5	**9.8**
1,1,1-Trichloroethane	16,000,000	**NA**	8,200	< 0.5	**11**
1,1,2-Trichloroethane	ND	**NA**	47	< 0.5	**1.2**
Trichloroethene	1,700,000	**2,100**	40,000	33	**0.17**
Vinyl chloride	2,000	**NA**	4,300	20	**0.015**
m-Xylene	NM	**NA**	NM	NM	**NA**
o-Xylene	1,200,000	**NA**	9,000	< 0.5	**13**
p-Xylene	950,000	**NA**	NM	NM	**NA**
m,p-Xylenes	4,200,000	**NA**	26,000	< 0.5	**1.8**
Benzo(b)fluoranthene	ND	**NA**	NM	NM	**0.018**
Indeno(1,2,3-cd)pyrene	ND	**100**	NM	NM	**0.018**

Table 4

Historical Soil and Groundwater Sampling Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Highest Soil Concentration[a] (ug/kg)	Soil SLV[d] (ug/kg)	Groundwater Concentration Highest[b] (ug/L)	Groundwater Concentration Adjacent[c] (ug/L)	Groundwater SLV[d] (ug/L)
Other Chemicals Detected During Site Investigations[e]					
2-Butanone (MEK)	200	**NA**	< 20	< 20	**7,100**
4-Methyl-2-pentanone (MIBK)	4,200	**NA**	5,300	< 0.5	**170**
Acetone	5,300	**NA**	2,800	< 0.5	**1,500**
Carbon Disulfide	8.4	**NA**	< 0.5	< 0.5	**0.92**
Carbon Tetrachloride	2,700	**NA**	< 0.5	< 0.5	**0.51**
Chloroethane	510	**NA**	1,200	17	**23**
Isopropylbenzene	16,000	**NA**	100	< 2.0	**660**
Dichloromethane (Methylene Chloride)	400	**NA**	6.9	< 2.0	**8.9**
Xylenes (total)	3,050,000	**NA**	31,100	< 1.0	**200**
Dichlorodifluoromethane (CFC 12)	6,700	**NA**	< 0.5	< 0.5	**NA**
n-Propylbenzene	78,000	**NA**	140	< 2.0	**NA**
1,3,5-Trimethylbenzene	150,000	**NA**	200	< 2.0	**NA**
1,2,4-Trimethylbenzene	480,000	**NA**	1,200	< 2.0	**NA**
sec-Butylbenzene	17,000	**NA**	2.3	< 2.0	**NA**
4-Isopropyltoluene	18,000	**NA**	28	< 2.0	**NA**
	66,000	**NA**	< 2.0	< 2.0	**NA**
1,3-Dichloropropane	ND	**NA**	0.83	0.83	**NA**
2,2-Dichloropropane	ND	**NA**	5.4	5.4	**NA**
1,2-Dichlorobenzene	110	**1,700**	29	< 0.5	**49**
1,4-Dichlorobenzene	ND	**300**	0.58	< 0.5	**2.8**
Naphthalene	32,000	**561**	390	< 2.0	**0.2**

Notes:

a) Highest soil concentration published in the RFI (HLA 1993), CMS (PES 2006), and data from the April 2008 CMI Design Investigation (PES 2008h), and September 2008 CMI Supplemental Design Investigation (PES 2008j).

b) Highest groundwater concentration from shallow groundwater monitoring wells and groundwater extraction wells reported in 2008 and 2009 progress reports (PES 2008c,h,i; PES 2009a,b), and a CMI Design Investigation summary letter (PES 2008j).

c) Highest reported groundwater concentration in groundwater monitoring wells adjacent to the 42-inch diameter stormwater mains along the eastern property boundary and in the NW Yeon Avenue frontage road. The wells include SMW-3, -9, -10, -11, 16, -17, -18, -21, -23, -24, and -27; PZ-3 and -9; and EXW-4A.

d) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Uplands Sites - Appendix D, January 2009 (DEQ 2009).

e) These chemicals were not retained as COCs in the CMS report (PES 2006), but were detected during site remedial investigations.

f) Detected chemical concentrations which exceed DEQ SLVs are highlighted in orange.

SLV = Screening Level Value
ug/L = micrograms per liter
ug/kg = micrograms per kilogram
ND = Not Detected - various MRLs

NM = Not Measured
NA = Not Applicable
MRL = Method Reporting Limit

Table 5

Historical Groundwater Treatment System Discharge Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Discharge Permit Limits[a] Daily Maximum (ug/L)	Discharge Permit Limits[a] Average Monthly Maximum (ug/L)	Groundwater SLV[c] (ug/L)	Laboratory MRL[b] (ug/L)	Historical Detections Total Number of Detections[d]	Historical Detections Range of Detections (ug/L)
Benzene	**8**	**5**	**1.2**	5	0	NA
Chloroethane	**8**	**5**	**23**	5	0	NA
1,2-Dichloroethane	**8**	**5**	**0.73**	5	0	NA
cis-1,2-Dichloroethene	**40[e]**	**25[e]**	**61**	5	6	7.6 - 40
trans-1,2-Dichloroethene	**40[e]**	**25[e]**	**100**	5	0	NA
Tetrachloroethene	**48**	**30**	**0.12**	5	2	5.9 - 71
1,1,1-Trichloroethane	**21**	**13**	**11**	5	2	5.3 - 42
1,1,2-Trichloroethane	**8**	**5**	**1.2**	5	0	NA
Trichloroethene	**125**	**78**	**0.17**	5	4	5 - 100
Vinyl chloride	**18**	**11**	**0.015**	5	0	NA
Cyanide	**65**	**50**	**5.2**	10	7	8 - 20
Oil and Grease	**15,000**	**10,000**	**NA**	5,000	2	2,300 - 5,600
pH	**6.5 - 8.5**	**6.5 - 8.5**	**NA**	NA	NA	NA
Other Chemicals Detected in Water Treatment System Discharge[f]						
2-butanone (MEK)	**NA**	**NA**	**7,100**	5	1	31
Ethylbenzene	**NA**	**NA**	**7.3**	5	2	5.7 - 11
Toluene	**NA**	**NA**	**9.8**	5	4	15 - 120
m,p-Xylenes	**NA**	**NA**	**1.8**	5	3	6.4 - 30
o-Xylene	**NA**	**NA**	**13**	5	1	7.3

Notes:

a) Discharge limits per NPDES Waste Discharge Permit No. 101613 (DEQ 2004).

b) Laboratory method reporting limit (MRL) for VOCs is EPA Method 624.

c) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Uplands Sites - Appendix D, January 2009 (DEQ 2009).

d) Number of detections of parameter in monthly compliance monitoring samples since water treatment system startup in 2001.

e) Discharge permit levels are listed for the sum of cis- and trans- isomers of 1,2-dichloroethene.

f) These parameters do not have discharge permit levels, but have been detected in water treatment system discharge at least one time since water treatment system startup in 2001.

g) Detected chemical concentrations which exceed DEQ SLVs are highlighted in orange.

NA = Not Applicable

MRL = Method Reporting Limit

ug/L = micrograms per liter

SLV = Screening Level Value

Table 6

Historical Stormwater Sampling Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Units	Stormwater Benchmark[a] (ug/L)	Stormwater SLV[b] (ug/L)	Laboratory MRL (ug/L)	Historical Data[c]: Summary of Detected Concentrations Minimum (ug/L)	Maximum (ug/L)	Average (ug/L)	Total Number of Detections	Total Number of Samples
Copper	**ug/L**	**100**	**2.7**	10	4.53	108	27	37	49
Lead	**ug/L**	**400**	**0.54**	2	3.2	141	20	48	49
Zinc	**ug/L**	**600**	**36**	10	54.9	824	214	49	49
Oil and Grease	**mg/L**	**10**	**NA**	5	5.2	16	9.2	15	49
Total Suspended Solids	**mg/L**	**130**	**NA**	5	7	1,420	141	49	49
pH	**Standard Units**	**5.5 - 9.0**	**NA**	NA	4.9	9.6	7.0	49	49

Notes:

a) Discharge limits per NPDES Waste Discharge Permit No. 101613 (DEQ 2004).

b) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Uplands Sites - Appendix D, January 2009 (DEQ 2009).

c) Historical data from 49 stormwater samples collected during 17 stormwater sampling events beginning in the 1999/2000 rainy season through the 2007/2008 rainy season as reported in annual submittals to DEQ (ITC 2000, 2001b; PES 2002, 2003, 2004, 2005, 2006b, 2007, 2008f).

d) Detected chemical concentrations which exceed DEQ SLVs are highlighted in orange.

MRL = Method Reporting Limit
SLV = Screening Level Value
ug/L = Micrograms per liter
O&G = Oil and Grease
TSS = Total Suspended Solids
NA = Not Applicable
NM = Not Measured
NS = Not Sampled

Table 7

Industrial Wastewater Permit Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Discharge Permit Limits[a] (ug/L)	Screening Level Value (SLV)[b] (ug/L)
Arsenic	200	**0.045**
Cadmium	700	**0.094**
Chromium	5,000	**100**
Copper	3,700	**2.7**
Lead	700	**0.54**
Mercury	10	**0.77**
Molybdenum	1,400	**NA**
Nickel	2,800	**16**
Selenium	600	**5.0**
Silver	400	**0.12**
Zinc	3,700	**36**
1,2-Dichloroethane	500	**61**
Acrylonitrile	1,000	**0.12**
Chlorobenzene	200	**50**
Chloroform	200	**0.17**
Trichloroethene	200	**0.17**
Nitrobenzene	2,000	**3.4**
2,4-dinitrotoluene	130	**3.4**
Pentachlorophenol	40	**0.56**
Chlordane	30	**0.00081**
Sulfide (dissolved)	4,000	**NA**
Cyanide	1,200	**5.2**
Non-polar Oil and Grease	110,000	**NA**
pH	5.5 - 11.5	**NA**
Other Chemicals Reportedly Present in Wastewater[c]		
Acetone	NA	**1,500**
Toluene	NA	**9.8**
Sulfate	NA	**NA**
Ammonia	NA	**NA**
Di-n-butyl phthalate	NA	**3.0**
bis-2-ethylhexylphthalate	NA	**2.2**

Notes:

a) Discharge permit limit listed in BES Industrial Wastewater Discharge Permit No. 400.025, expires March 3, 2011 (BES 2006a)

b) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Uplands Sites - Appendix D, January 2009 (DEQ 2009).

c) These parameters do not have discharge permit levels, but are listed in the discharge permit because the parameters have been detected in the wastewater stream at concentrations less than 1 milligram per liter on average.

ug/L = micrograms per liter
NA = Not Applicable

Table 8

Storm Sewer Inspection - Sediment Waste Characterization Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter	Sediment Concetration[a] (ug/kg)	Screening Level Value (SLV)[b] (ug/kg)
cis-1,2-Dichloroethene	18,000	**NA**
Ethylbenzene	8,000	**NA**
Tetrachloroethene	120,000	**500**
Toluene	22,000	**NA**
Trichloroethene	19,000	**2,100**
Total Xylenes	18,000	**NA**

Notes:

a) Sediment concentration reported in Progress Report 50 (VWR 1996) for characterization of 15 to 20 cubic yards of sediment generated during cleaning of the 42-inch storm sewer main on the eastern property boundary.

b) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Uplands Sites - Appendix D, January 2009 (DEQ 2009).

c) Detected chemical concentrations which exceed DEQ SLVs are highlighted in orange.

ug/kg = micrograms per kilogram
NA = Not Applicable

Table 9

Eastern Drive Soil Sampling Data
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter[a]	Highest Soil Concentration[b] (ug/kg)	Soil Screening Level Value[c] (ug/kg)
Arsenic	1,900	**7,000**
Barium	151,000	**NA**
Chromium	23,400	**111,000**
Lead	27,800	**17,000**
Mercury	60	**70**
gamma-chlordane[d]	63	**0.37**
alpha-chlordate[d]	43	**0.37**
Dieldrin	10	**0.0081**
4,4'-DDE[e]	23	**0.33**
4,4'-DDD[e]	8.3	**0.33**
4,4'-DDT[e]	72	**0.33**
Heptachlor	11	**10**
Acetone	220	**NA**
2-butanone (MEK)	39	**NA**
cis-1,2-Dichloroethene	530	**NA**
Tetrachloroethene	14,000	**500**
Toluene	9.5	**NA**
Trichloroethene	2,200	**2,100**
1,2,4-Trimethylbenzene	34	**NA**
m,p-Xylenes	22,000	**NA**
o-Xylene	11,000	**NA**
Pentachlorophenol	6.0	**250**
TPH - diesel range	41,000	**NA**
TPH - oil range	290,000	**NA**

Notes:

a) Eastern driveway soil samples were also analyzed for chlorinated herbicides by EPA Method 8151A. There were no detections of chlorinated herbicides above laboratory method reporting limits.

b) Highest soil concentration in soil samples collected in the top 18-inches in the eastern driveway.

c) Screening level value listed in DEQ Guidance for Evaluating the Stormwater Pathway at Cleanup Sites - Appendix D, Public review draft. May 1, 2008 (DEQ 2008).

d) The screening level value is chlordane (CAS # 57-74-9).

e) Screening level is for the sum of 2,4' and 4,4' isomers.

f) Detected chemical concentrations which exceed DEQ SLVs are highlighted in orange.

SLV = Screening Level Value
ug/kg = micrograms per kilogram
NA = Not Applicable

Table 10

Analytical Methods
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Method Number	Analysis	Analysis Priority	Container[a] Type	Container[a] Size	Preservative	Maximum Holding Time
Stormwater Samples						
EPA 160.2	Total suspended solids (TSS)	1	Poly	1 liter	4 ± 2°C	7 days
EPA 415.1	Total organic carbon (TOC)	2	Poly	250 ml	4 ± 2°C, H_2SO_4 to pH < 2	28 days
EPA 200.7/200.8	Total and dissolved metals[b]	3	Poly	500 ml	4 ± 2°C, HNO_3 to pH < 2	6 months
EPA 1631M	Mercury	4	Poly	500 ml	4 ± 2°C, HNO_3 to pH < 2	28 days
EPA 8260b	VOCs	5	Glass	3 x 40 ml	4 ± 2°C, HCl to pH < 2	14 days
8270C	SVOCs	6	Amber Glass	1 liter	4 ± 2°C	7/40 days[c]
8270C (SIM)	PAHs					
EPA 8082	PCB Congeners	7	Amber Glass	2 liter	4 ± 2°C	7/40 days[c]
EPA 8151A	Chlorinated herbicides	8	Amber Glass	1 liter	4 ± 2°C	7/40 days[c]
EPA 8081 (ULL)	Organochlorine pesticides	9	Amber Glass	1 liter	4 ± 2°C	7/40 days[c]
EPA 335.4	Cyanide (total)	10	Poly	500 ml	4 ± 2°C, NaOH to pH > 12	14 days
EPA 9014	Cyanide (free)					
EPA 335.1	Cyanide (amenable)					
EPA 1664	Oil and Grease (HEM)	11	Amber Glass	1 liter	4 ± 2°C, H_2SO_4 to pH < 2	28 days
NWTPH-Dx	Diesel and Residual Range - TPH	12	Amber Glass	1 liter	4 ± 2°C	7/40 days[c]
EPA 9030b	Sulfides	13	Amber Glass	250 ml	250 ml	7 days
EPA 300/9056	Sulfate	14	Poly	250 ml	250 ml	28 days
EPA 350.1	Ammonia as Nitrogen	15	Poly	250 ml	4 ± 2°C, H_2SO_4 to pH < 2	28 days

Table 10

Analytical Methods
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Method Number	Analysis	Analysis Priority	Container[a] Type	Container[a] Size	Preservative	Maximum Holding Time
Sediment Samples						
EPA 8082	PCB Congeners	1	Glass	8 oz.	4 ± 2°C	7/40 days[c]
EPA 8081	Organochlorine pesticides	2				7/40 days[c]
EPA 6020	Metals[b]	3				6 months
EPA 7471A	Mercury	4				28 days
EPA 8270C	SVOCs	5				7/40 days[c]
EPA 8151A	Chlorinated herbicides	6				7/40 days[c]
EPA 1613b	Dioxins and Furans	7	Glass	4 oz.	4 ± 2°C	30 days/1 yr[d]
EPA 8260b	VOCs	8	Glass	8 oz.	4 ± 2°C	14 days
NWTPH-Dx	Diesel and Residual Range - TPH	9	Glass	4 oz.	4 ± 2°C	14/40 days[e]
Plume et al 1981	Total organic carbon (TOC)	10	Glass	8 oz.	4 ± 2°C	28 days
PSEP 1986	Percent solids	11				6 months
PESP 1986	Grain Size	12				NA
EPA 9030b	Sulfides	13	Glass	4 oz.	4 ± 2°C, zinc acetate	7 days
EPA 300M/9056	Sulfate	14	Glass	4 oz.	4 ± 2°C	28 days
EPA 350.1M	Ammonia as Nitrogen	15	Glass	4 oz.	4 ± 2°C	28 days

Notes:

a) The size and number of containers may be modified by the analytical laboratories.

b) Total metals include Aluminum (Al), Antimony (Sb), Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Manganese (Mn), Molybdenum (Mo), Nickel (Ni), Selenium (Se), Silver (Ag), and Zinc (Zn). Samples submitted for Iron (Fe) analysis will be filtererd and analysed for the dissolved fraction only.

c) The holding time is 7 days from collection to extraction, and 40 days from extraction to analysis.

d) The maximum holding time is 30 days, or 1 year if the sample is frozen.

e) The holding time is 14 days from collection to extraction, and 40 days from extraction to analysis.

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water MDL (ug/L)	Water MRL[b] (ug/L)	Water SLV (ug/L)	Sediment Analyses Lab Method	Sediment MDL (ug/kg)	Sediment MRL[b,c] (ug/kg)	Sediment SLV (ug/kg)
Metals and inoranics									
Aluminum	7429-90-5	200.8	0.3	2.0	50	6020	500	2000	NA
Antimony	7440-36-0	200.8	0.03	0.05	6.0	6020	30	50	64,000
Arsenic	7440-38-2	200.8	0.08	0.50	0.045	6020	10	500	7,000
Cadmium	7440-43-9	200.8	0.008	0.02	0.094	6020	8	20	1,000
Chromium (total)	7440-47-3	200.8	0.07	0.20	100	6020	40	200	111,000
Copper	7440-50-8	200.8	0.02	0.10	2.7	6020	100	100	149,000
Iron (dissolved)	7439-89-6	200.7	3.0	20	NA	6010B	300	4000	NA
Lead	7439-92-1	200.8	0.009	0.02	0.54	6020	20	50	17,000
Manganese	7439-96-5	200.8	0.02	0.05	50	6020	40	50	1,100,000
Mercury	7439-97-6	1631M	0.00006	0.001	0.77	7471A	6.0	20	70
Molybdenum	7439-98-7	200.8	0.008	0.05	NA	6020	20	50	NA
Nickel	7440-02-0	200.8	0.07	0.20	16	6020	50	200	48,600
Selenium	7782-49-2	200.8	0.4	1.0	5.0	6020	400	1000	2,000
Silver	7440-22-4	200.8	0.009	0.02	0.12	6020	20	20	5,000
Zinc	7440-66-6	200.8	0.1	0.50	36	6020	200	500	459,000
Cyanide (total)	57-12-5	335.4	3.0	10	5.2	NA	NA	NA	NA
Cyanide (amenable)	57-12-5	9014	3.0	10	5.2	NA	NA	NA	NA
Cyanide (free)	57-12-5	335.1	3.0	10	5.2	NA	NA	NA	NA
Sulfides	18496-25-8	9030B	30	100	NA	9030B	20	50	NA
Sulfate	14808-79-8	300/9056	10	200	NA	300M/9056	100	2000	NA
Ammonia (as Nitrogen)	7664-41-7	350.1	50	5.0	NA	350.1M	40	500	NA
Polychlorinated Biphenyl (PCB) Congeners (select list of 35)									
2,4'-DiCB (PCB-8)	34883-43-7	8082	0.00084	0.005	NA	8082	0.12	0.50	NA
2,2',5-TrCB (PCB-18)	37680-65-2	8082	0.00074	0.005	NA	8082	0.099	0.50	NA
2,4,4'-TrCB (PCB-28)	7012-37-5	8082	0.00034	0.005	NA	8082	0.16	0.50	NA
2,2',3,5'-TeCB (PCB-44)	41464-39-5	8082	0.00031	0.005	NA	8082	0.047	0.50	NA
2,2',5,5'-TeCB (PCB-52)	35693-99-3	8082	0.00032	0.005	NA	8082	0.062	0.50	NA
2,3,4,4'-TeCB (PCB-60)	33025-41-1	8082	0.00039	0.005	NA	8082	0.029	0.50	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	MDL (ug/L)	MRL[b] (ug/L)	SLV (ug/L)	Sediment Analyses Lab Method	MDL (ug/kg)	MRL[b,c] (ug/kg)	SLV (ug/kg)
2,3',4,4'-TeCB (PCB-66)	32598-10-0	8082	0.0003	0.005	NA	8082	0.048	0.50	NA
3,3',4,4'-TCB (PCB-77)	32598-13-3	8082	0.00029	0.005	NA	8082	0.065	0.50	0.052
3,4,4',5-TCB (PCB-81)	70362-50-4	8082	0.00034	0.005	NA	8082	0.041	0.50	0.017
2,2',3,4,5'-PeCB (PCB-87)	38380-02-8	8082	0.00042	0.005	NA	8082	0.031	0.50	NA
2,2',3,4',5-PeCB (PCB-90)	68194-07-0	8082	0.00033	0.005	NA	8082	0.027	0.50	NA
2,2',4,5,5'-PeCB (PCB-101)	37680-73-2	8082	0.00074	0.005	NA	8082	0.091	0.50	NA
2,3,3',4,4'-PeCB (PCB-105)	32598-14-4	8082	0.00027	0.005	NA	8082	0.053	0.50	0.17
2,3,4,4',5-PeCB (PCB-114)	74472-37-0	8082	0.00054	0.005	NA	8082	0.035	0.50	0.17
2,3',4,4',5-PeCB (PCB-118)	31508-00-6	8082	0.000099	0.005	NA	8082	0.025	0.50	0.12
2',3,4,4',5-PeCB (PCB-123)	65510-44-3	8082	0.00083	0.005	NA	8082	0.054	0.50	0.21
3,3',4,4',5-PeCB (PCB-126)	57465-28-8	8082	0.00037	0.005	NA	8082	0.039	0.50	0.00005
2,2',3,3',4,4'-HxCB (PCB-128)	38380-07-3	8082	0.00057	0.005	NA	8082	0.04	0.50	NA
2,2',3,4,4',5'-HxCB (PCB-138)	35065-28-2	8082	0.00062	0.005	NA	8082	0.04	0.50	NA
2,2',4,4',5,5'-HxCB (PCB-153)	35065-27-1	8082	0.00048	0.005	NA	8082	0.057	0.50	NA
2,3,3',4,4',5-HxCB (PCB-156)	38380-08-4	8082	0.00034	0.005	NA	8082	0.045	0.50	0.21
2,3,3',4,4',5'-HxCB (PCB-157)	69782-90-7	8082	0.00013	0.005	NA	8082	0.05	0.50	0.21
2,3,3',4,4',6-HxCB (PCB-158)	74472-42-7	8082	0.0003	0.005	NA	8082	0.039	0.50	NA
2,3,4,4',5,6-HxCB (PCB-166)	41411-63-6	8082	0.00033	0.005	NA	8082	0.048	0.50	NA
2,3',4,4',5,5'-HxCB (PCB-167)	52663-72-6	8082	0.00029	0.005	NA	8082	0.076	0.50	0.21
3,3',4,4',5,5'-HxCB (PCB-169)	32774-16-6	8082	0.00034	0.005	NA	8082	0.06	0.50	0.00021
2,2',3,3',4,4',5-HpCB (PCB-170)	35065-30-6	8082	0.00012	0.005	NA	8082	0.036	0.50	NA
2,2',3,4,4',5,5'-HpCB (PCB-180)	35065-29-3	8082	0.00037	0.005	NA	8082	0.052	0.50	NA
2,2',3,4,4',5',6-HpCB (PCB-183)	52663-69-1	8082	0.00077	0.005	NA	8082	0.035	0.50	NA
2,2',3,4,4',6,6'-HpCB (PCB-184)	74472-48-3	8082	0.00034	0.005	NA	8082	0.05	0.50	NA
2,2',3,4,5,5',6-HpCB (PCB-187)	52663-68-0	8082	0.00027	0.005	NA	8082	0.076	0.50	NA
2,3,3',4,4',5,5'-HpCB (PCB-189)	39635-31-9	8082	0.00053	0.005	NA	8082	0.047	0.50	1.2
2,2',3,3',4,4',5,6-OcCB (PCB-195)	52663-78-2	8082	0.00033	0.005	NA	8082	0.037	0.50	NA
2,2',3,3',4,4',5,5',6-NoCB (PCB-206)	40186-72-9	8082	0.00055	0.005	NA	8082	0.038	0.50	NA
DeCB (PCB-209)	32774-16-6	8082	0.00048	0.005	NA	8082	0.03	0.50	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses				Sediment Analyses			
		Lab Method	MDL (ug/L)	MRL[b] (ug/L)	SLV (ug/L)	Lab Method	MDL (ug/kg)	MRL[b,c] (ug/kg)	SLV (ug/kg)
Chlorinated Herbicides									
Dapalon	75-99-0	8151A	0.06	0.4	200	8151A	31	50	NA
Dicamba	1918-00-9	8151A	0.07	0.4	1,100	8151A	3.5	50	NA
MCPA	94-74-6	8151A	24	100	18	8151A	500	10,000	NA
Dichloroprop	120-36-5	8151A	0.06	0.4	370	8151A	3.0	50	NA
2,4-D	94-75-7	8151A	0.08	0.4	70	8151A	3.7	50	NA
2,4,5-TP (Silvex)	93-72-1	8151A	0.08	0.4	50	8151A	3.6	50	NA
2,4,5-T	93-76-5	8151A	0.02	0.4	370	8151A	4.0	50	NA
2,4-DB	94-82-6	8151A	0.13	0.4	290	8151A	6.9	50	NA
Dinoseb	88-85-7	8151A	0.09	0.4	7.0	8151A	6.3	50	NA
MCPP	93-65-2	8151A	23	100	37	8151A	250	10,000	NA
Organochlorine Pesticides									
alpha-BHC	319-84-6	8081 ULL	0.00021	0.0005	0.0049	8081	0.26	1	NA
beta-BHC	319-85-7	8081 ULL	0.00041	0.0005	0.017	8081	0.3	1	NA
gamma-BHC (Lindane)	58-89-9	8081 ULL	0.00047	0.0005	0.052	8081	0.15	1	4.99
delta-BHC	319-86-8	8081 ULL	0.00014	0.0005	0.037	8081	0.055	1	NA
Heptachlor	76-44-8	8081 ULL	0.00018	0.0005	0.000079	8081	0.08	1	10
Heptachlor epoxide	102-45-73	8081 ULL	0.00021	0.0005	0.000039	8081	0.13	1	16
Aldrin	309-00-2	8081 ULL	0.00011	0.0005	0.00005	8081	0.15	1	40
Chlordane - total[d]	57-74-9	8081 ULL	0.00031	0.0005	0.00081	8081	0.23	1	0.37
gamma-Chlordane	5103-71-9	8081 ULL	0.00031	0.0005	NA	8081	0.064	1	NA
alpha-Chlordane	5103-74-2	8081 ULL	0.00027	0.0005	NA	8081	0.23	1	NA
Oxychlordane	NA	8081 ULL	TBD	0.0005	0.19	8081	TBD	1	NA
cis -Nonachlor	5103-73-1	8081 ULL	TBD	0.0005	0.19	8081	TBD	1	NA
trans -Nonachlor	39765-80-5	8081 ULL	TBD	0.0005	0.19	8081	TBD	1	NA
Endosulfan alpha-	959-98-8	8081 ULL	0.00025	0.0005	0.056	8081	0.17	1	NA
Endosulfan beta-	33213-65-9	8081 ULL	0.00035	0.0005	0.056	8081	0.19	1	NA
Endosulfan sulfate	1031-07-8	8081 ULL	0.00028	0.0005	89	8081	0.079	1	NA
DDE (sum 2,4' & 4,4')	NA	8081 ULL	0.00019	0.0005	0.00022	8081	0.1	1	0.33

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	MDL (ug/L)	MRL[b] (ug/L)	SLV (ug/L)	Sediment Analyses Lab Method	MDL (ug/kg)	MRL[b,c] (ug/kg)	SLV (ug/kg)
2,4'-DDE	3424-82-6	8081 ULL	TBD	0.0005	NA	8081	TBD	1	NA
4,4'-DDE	72-55-9	8081 ULL	0.00019	0.0005	NA	8081	0.1	1	NA
DDD (sum 2,4' & 4,4')	NA	8081 ULL	0.00021	0.0005	0.00031	8081	0.12	1	0.33
2,4'-DDD	53-19-0	8081 ULL	TBD	0.0005	NA	8081	TBD	1	NA
4,4'-DDD	72-54-8	8081 ULL	0.00021	0.0005	NA	8081	0.12	1	NA
DDT (sum 2,4' & 4,4')	NA	8081 ULL	0.00017	0.0005	0.00022	8081	0.064	1	0.33
2,4'-DDT	789-02-6	8081 ULL	TBD	0.0005	NA	8081	TBD	1	NA
4,4'-DDT	50-29-3	8081 ULL	0.00017	0.0005	NA	8081	0.064	1	NA
DDT - total (sum DDE, DDE, & DDT)	50-29-3	8081 ULL	0.000212	0.0005	0.20	8081	0.12	1	0.33
Dieldrin	60-57-1	8081 ULL	0.00037	0.0005	0.000054	8081	0.29	1	0.0081
Endrin	72-20-8	8081 ULL	0.00049	0.0005	0.036	8081	0.2	1	207
Endrin aldehyde	7421-93-4	8081 ULL	0.00021	0.0005	0.30	8081	0.053	1	NA
Endrin ketone	53494-70-5	8081 ULL	0.00032	0.0005	NA	8081	0.082	1	NA
Methoxychlor	72-43-5	8081 ULL	0.00028	0.0005	0.03	8081	0.1	1	NA
Toxaphene	8001-35-2	8081 ULL	0.009	0.025	0.0002	8081	9.2	50	NA
Hexachlorobenzene	118-74-1	8081 ULL	0.0001	0.0005	0.00029	8081	0.2	1	19
Volatile Organic Compounds (VOCs)									
1,1,1,2-Tetrachloroethane	630-20-6	8260B	0.047	0.50	2.5	8260B	0.076	5.0	NA
1,1,1-Trichloroethane (TCA)	71-55-6	8260B	0.050	0.50	11	8260B	0.066	5.0	NA
1,1,2,2-Tetrachloroethane	79-34-5	8260B	0.064	0.50	0.33	8260B	0.11	5.0	NA
1,1,2-Trichloroethane	79-00-5	8260B	0.061	0.50	1.2	8260B	0.11	5.0	NA
1,1-Dichloroethane	75-34-3	8260B	0.042	0.50	47	8260B	0.068	5.0	NA
1,2,3-Trichloropropane	96-18-4	8260B	0.14	0.50	0.0095	8260B	0.29	5.0	NA
1,2-Dichloroethane (EDC)	107-06-2	8260B	0.073	0.50	0.73	8260B	0.057	5.0	NA
1,2-Dichloropropane	78-87-5	8260B	0.042	0.50	0.97	8260B	0.094	5.0	NA
1,2-Dibromoethane (EDB)	106-93-4	8260B	0.084	2.0	0.033	8260B	0.093	20	NA
2-Butanone (MEK)	78-93-3	8260B	3.8	20	7,100	8260B	1.1	20	NA
2-Chloroethylvinylether	110-75-8	8260B	0.19	5.0	NA	8260B	0.31	10	NA
2-Hexanone	591-78-6	8260B	2.9	20	99	8260B	0.59	20	NA
4-Methyl-2-pentanone (MIBK)	108-10-1	8260B	3.0	20	170	8260B	0.22	20	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water MDL (ug/L)	Water MRL[b] (ug/L)	Water SLV (ug/L)	Sediment Analyses Lab Method	Sediment MDL (ug/kg)	Sediment MRL[b,c] (ug/kg)	Sediment SLV (ug/kg)
Acetone	67-64-1	8260B	2.5	20	1,500	8260B	1.8	20	NA
Acrolein	107-02-8	8260B	2.0	50	0.042	8260B	1.7	100	NA
Acrylonitrile	107-13-1	8260B	0.31	5.0	0.12	8260B	0.46	20	NA
Bromochloromethane	74-97-5	8260B	0.091	0.50	NA	8260B	0.18	5.0	NA
Bromodichloromethane	75-27-4	8260B	0.036	0.50	1.1	8260B	0.11	5.0	NA
Bromoform	75-25-2	8260B	0.08	0.50	8.5	8260B	0.19	5.0	NA
Bromomethane	74-83-9	8260B	0.072	0.50	8.7	8260B	0.51	5.0	NA
Carbon Disulfide	75-15-0	8260B	0.045	0.50	0.92	8260B	0.057	5.0	NA
Carbon Tetrachloride	56-23-5	8260B	0.068	0.50	0.51	8260B	0.072	5.0	NA
Chlorobenzene	108-90-7	8260B	0.045	0.50	50	8260B	0.051	5.0	NA
Dibromochloromethane	124-48-1	8260B	0.057	0.50	0.79	8260B	0.096	5.0	NA
Chloroethane	75-00-3	8260B	0.13	0.50	23	8260B	0.24	5.0	NA
Chloroform	67-66-3	8260B	0.042	0.50	0.17	8260B	0.063	5.0	NA
Chloromethane	74-87-3	8260B	0.053	0.50	2.1	8260B	0.11	5.0	NA
cis-1,2-Dichloroethene	156-59-2	8260B	0.045	0.50	61	8260B	0.1	5.0	NA
cis-1,3-Dichloropropene	10061-01-5	8260B	0.038	0.50	0.055	8260B	0.056	5.0	NA
Dibromomethane	74-95-3	8260B	0.089	0.5	61	8260B	0.15	5.0	NA
Dichlorodifluoromethane	75-71-8	8260B	0.083	0.5	390	8260B	0.066	5.0	NA
Iodomethane	74-88-4	8260B	0.27	5.0	NA	8260B	0.35	20	NA
Isopropylbenzene	98-82-8	8260B	0.031	2.0	660	8260B	0.05	20	NA
Dichloromethane (Methylene Chloride)	75-09-2	8260B	0.23	2.0	8.9	8260B	0.14	10	NA
Styrene	100-42-5	8260B	0.039	0.50	100	8260B	0.067	5.0	NA
Trans-1,4-Dichloro-2-Butene	110-57-6	8260B	0.20	10	7,100	8260B	0.41	20	NA
Trichlorofluoromethane	75-69-4	8260B	0.086	0.50	1,300	8260B	0.11	5.0	NA
Vinyl Acetate	108-05-4	8260B	0.91	5.0	16	8260B	0.95	20	NA
Benzene	71-43-2	8260B	0.045	0.50	1.2	8260B	0.079	5.0	NA
Ethylbenzene	100-41-4	8260B	0.042	0.50	7.3	8260B	0.065	5.0	NA
m,p-Xylenes	179601-23-1	8260B	0.078	0.50	1.8	8260B	0.15	5.0	NA
o-Xylene	95-47-6	8260B	0.037	0.50	13	8260B	0.057	5.0	NA
Total Xylenes	1130-20-7	8260B	0.078	0.50	200	8260B	0.15	5.0	NA
Tetrachloroethene (PCE)	127-18-4	8260B	0.077	0.50	0.12	8260B	0.076	5.0	500

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water Analyses MDL (ug/L)	Water Analyses MRL[b] (ug/L)	Water Analyses SLV (ug/L)	Sediment Analyses Lab Method	Sediment Analyses MDL (ug/kg)	Sediment Analyses MRL[b,c] (ug/kg)	Sediment Analyses SLV (ug/kg)
Toluene	108-88-3	8260B	0.048	0.50	9.8	8260B	0.13	5.0	NA
trans-1,2-Dichloroethene	156-60-5	8260B	0.048	0.50	100	8260B	0.084	5.0	NA
trans-1,3-Dichloropropene	10061-02-6	8260B	0.041	0.50	0.055	8260B	0.093	5.0	NA
Trichloroethene	79-01-6	8260B	0.061	0.50	0.17	8260B	0.07	5.0	2,100
Vinyl Chloride	75-01-4	8260B	0.071	0.50	0.015	8260B	0.094	5.0	NA
Dichlorodifluoromethane (CFC 12)	75-71-8	8260B	0.083	0.50	NA	8260B	0.073	5.0	NA
1,1-Dichloroethene	75-35-4	8260B	0.10	0.50	NA	8260B	0.057	5.0	NA
1,2,4-Trimethylbenzene	95-63-6	8260B	0.037	2.0	NA	8260B	0.07	20	NA
1,3,5-Trimethylbenzene	108-67-8	8260B	0.10	2.0	NA	8260B	0.069	20	NA
4-Isopropyltoluene	99-87-6	8260B	0.044	2.0	NA	8260B	0.066	20	NA
Naphthalene	91-20-3	8260B	0.10	2.0	0.20	8260B	0.14	20	561
n-Butylbenzene	104-51-8	8260B	0.056	2.0	NA	8260B	0.096	20	NA
n-Propylbenzene	103-65-1	8260B	0.037	2.0	NA	8260B	0.054	20	NA
sec-Butylbenzene	135-98-8	8260B	0.036	2.0	NA	8260B	0.072	20	NA
1,3-Dichloropropane	142-28-9	8260B	0.032	0.50	NA	8260B	0.083	5.0	NA
2,2-Dichloropropane	594-20-7	8260B	0.050	0.50	NA	8260B	0.083	5.0	NA
Semivolatile Organic Compounds (SVOCs)									
Halogenated Compounds									
1,2-Dichlorobenzene	95-50-1	8270C	0.02	0.2	49	8270C	2.9	10	1,700
1,3-Dichlorobenzene	541-73-1	8270C	0.02	0.2	14	8270C	3.0	10	300
1,4-Dichlorobenzene	106-46-7	8270C	0.02	0.2	2.8	8270C	2.9	10	300
1,2,4-Trichlorobenzene	120-82-1	8270C	0.02	0.2	8.2	8270C	2.6	10	9,200
Hexachlorobenzene	118-74-1	8270C	0.02	0.2	0.00029	8270C	1.2	10	19
2-Chloronaphthalene	91-58-7	8270C	0.04	0.2	490	8270C	1.6	10	NA
Hexachloroethane	67-72-1	8270C	0.02	0.2	3.3	8270C	3.1	10	NA
Hexachlorobutadiene	87-68-3	8270C	0.03	0.2	0.86	8270C	2.5	10	600
Hexachlorocyclopentadiene	77-47-4	8270C	0.19	1	5.2	8270C	29	50	400
Bis(2-chloroisopropyl) Ether	108-60-1	8270C	0.03	0.2	0.95	8270C	2.6	10	NA
Bis(2-chloroethoxy)methane	111-91-1	8270C	0.02	0.2	NA	8270C	1.5	10	NA
Bis(2-chloroethyl) Ether	111-44-4	8270C	0.04	0.2	0.06	8270C	1.9	10	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water Analyses MDL (ug/L)	Water Analyses MRL[b] (ug/L)	Water Analyses SLV (ug/L)	Sediment Analyses Lab Method	Sediment Analyses MDL (ug/kg)	Sediment Analyses MRL[b,c] (ug/kg)	Sediment Analyses SLV (ug/kg)
4-Chlorophenyl Phenyl Ether	7005-72-3	8270C	0.03	0.2	0.06	8270C	1.4	10	NA
4-Bromophenyl Phenyl Ether	101-55-3	8270C	0.03	2	NA	8270C	1.6	10	NA
3,3'-Dichlorobenzidine	91-94-1	8270C	0.43	2	0.028	8270C	3.7	100	NA
4-Chloroaniline	106-47-8	8270C	0.03	0.2	150	8270C	1.9	10	NA
Organonitrogen Compounds									
Nitrobenzene	98-95-3	8270C	0.03	0.2	3.4	8270C	2.2	10	NA
2-Nitroaniline	88-74-4	8270C	0.02	0.2	110	8270C	3.2	20	NA
3-Nitroaniline	99-09-2	8270C	0.03	1	3.2	8270C	2.5	20	NA
4-Nitroaniline	100-01-6	8270C	0.02	1	3.2	8270C	1.8	20	NA
N-Nitrosodimethylamine	62-75-9	8270C	TBD	TBD	0.00042	8270C	TBD	TBD	NA
N-Nitrosodi-n-propylamine	621-64-7	8270C	0.04	0.2	0.0096	8270C	2.4	10	NA
N-Nitrosodiphenylamine	86-30-6	8270C	0.05	0.2	6.0	8270C	1.6	10	NA
2,4-Dinitrotoluene	121-14-2	8270C	0.02	0.2	3.4	8270C	1.5	10	NA
2,6-Dinitrotoluene	606-20-2	8270C	0.03	0.2	37	8270C	2.0	10	NA
Carbazole	86-74-8	8270C	TBD	0.2	3.4	8270C	TBD	10	1,600
Oxygen - Containing Compounds									
Benzoic Acid	65-85-0	8270C	1.1	5	42	8270C	96	200	NA
Benzyl Alcohol	100-51-6	8270C	0.07	5	8.6	8270C	2.1	20	NA
Dibenzofuran	132-64-9	8270C	0.02	0.2	3.7	8270C	1.2	10	NA
Isophorone	78-59-1	8270C	0.02	0.2	71	8270C	1.0	10	NA
Phenols and Substituted Phenols									
Phenol	108-95-2	8270C	0.06	0.5	2,560	8270C	2.0	30	50
2-Methylphenol (o-Cresol)	95-48-7	8270C	0.11	0.5	13	8270C	1.5	10	NA
4-Methylphenol (p-Cresol)	106-44-5	8270C	0.12	0.5	180	8270C	1.5	10	NA
2,4-Dimethylphenol	105-67-9	8270C	2.2	4.0	730	8270C	5.5	50	NA
2-Chlorophenol	95-57-8	8270C	0.05	0.5	30	8270C	2.0	10	NA
2,4-Dichlorophenol	120-83-2	8270C	0.05	0.5	110	8270C	1.0	10	NA
2,4,5-Trichlorophenol	95-95-4	8270C	0.03	0.5	3,600	8270C	1.5	10	NA
2,4,6-Trichlorophenol	88-06-2	8270C	0.058	0.5	2.4	8270C	1.4	10	NA
Pentachlorophenol (PCP)	87-86-5	8270C	0.34	1.0	0.56	8270C	20.0	100	1,000
4-Chloro-3-methylphenol	59-50-7	8270C	0.04	0.5	NA	8270C	1.4	10	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water MDL (ug/L)	Water MRL[b] (ug/L)	Water SLV (ug/L)	Sediment Analyses Lab Method	Sediment MDL (ug/kg)	Sediment MRL[b,c] (ug/kg)	Sediment SLV (ug/kg)
2-Nitrophenol	88-75-5	8270C	0.06	0.5	150	8270C	1.5	10	NA
4-Nitrophenol	100-02-7	8270C	0.28	2.0	150	8270C	18	100	NA
2,4-Dinitrophenol	51-28-5	8270C	0.17	4.0	73	8270C	17	200	NA
2-Methyl-4,6-dinitrophenol	534-52-1	8270C	0.03	2.0	150	8270C	1.4	100	NA
Phthalate Esters									
Dimethyl Phthalate	131-11-3	8270C	0.02	0.2	3.0	8270C	1.0	10	NA
Diethyl Phthalate	84-66-2	8270C	0.01	0.2	3.0	8270C	1.3	10	600
Di-n-butyl Phthalate	84-74-2	8270C	0.02	0.2	3.0	8270C	7.9	20	100
Butyl Benzyl Phthalate	85-68-7	8270C	0.02	0.2	3.0	8270C	3.2	10	NA
Di-n-octyl Phthalate	117-84-0	8270C	0.02	0.2	3.0	8270C	1.7	10	NA
Bis(2-ethylhexyl) Phthalate	117-81-7	8270C	0.13	1.0	2.2	8270C	7.0	100	800
Polycyclic Aromatic Hydrocarbons (PAHs)									
Naphthalene	91-20-3	8270C SIM	0.003	0.02	0.20	8270C	2.3	10	561
2-Methylnaphthalene	91-57-6	8270C SIM	0.0023	0.02	0.20	8270C	2.2	10	200
Acenaphthylene	208-96-8	8270C SIM	0.0034	0.02	0.20	8270C	1.2	10	200
Acenaphthene	83-32-9	8270C SIM	0.0044	0.02	0.20	8270C	1.4	10	300
Fluorene	86-73-7	8270C SIM	0.0038	0.02	0.20	8270C	1.1	10	536
Phenanthrene	85-01-8	8270C SIM	0.0044	0.02	0.20	8270C	1.4	10	1,170
Anthracene	120-12-7	8270C SIM	0.0036	0.02	0.20	8270C	1.6	10	845
Fluoranthene	206-44-0	8270C SIM	0.0044	0.02	0.20	8270C	1.6	10	2,230
Pyrene	129-00-0	8270C SIM	0.0035	0.02	0.20	8270C	1.5	10	1,520
Benz(a)anthracene	56-55-3	8270C SIM	0.0026	0.02	0.018	8270C	1.7	10	1,050
Chrysene	218-01-9	8270C SIM	0.0034	0.02	0.018	8270C	1.5	10	1,290
Benzo(b)fluoranthene	205-99-2	8270C SIM	0.0023	0.02	0.018	8270C	1.2	10	NA
Benzo(k)fluoranthene	207-08-9	8270C SIM	0.0025	0.02	0.018	8270C	1.4	10	13,000
Benzo(a)pyrene	50-32-8	8270C SIM	0.0043	0.02	0.018	8270C	1.7	10	1,450
Indeno(1,2,3-cd)pyrene	193-39-5	8270C SIM	0.0026	0.02	0.018	8270C	1.5	10	100
Dibenz(a,h)anthracene	53-70-3	8270C SIM	0.0025	0.02	0.018	8270C	1.5	10	1,300
Benzo(g,h,i)perylene	191-24-2	8270C SIM	0.0029	0.02	0.20	8270C	1.5	10	300

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses Lab Method	Water Analyses MDL (ug/L)	Water Analyses MRL[b] (ug/L)	Water Analyses SLV (ug/L)	Sediment Analyses Lab Method	Sediment Analyses MDL (ug/kg)	Sediment Analyses MRL[b,c] (ug/kg)	Sediment Analyses SLV (ug/kg)
Chlorinated Dioxins and Furans									
Dioxins									
2,3,7,8,-TCDD (TEQ)	1746-01-6	NA	NA	NA	5.10E-09	1613B	NA	NA	NA
2,3,7,8,-TCDD	1746-01-6	NA	NA	NA	5.10E-09	1613B	0.000049	0.001	0.0000091
1,2,3,7,8,-PeCDD	40321-76-4	NA	NA	NA	NA	1613B	0.000038	0.005	0.0026
1,2,3,4,7,8-HxCDD	39227-28-6	NA	NA	NA	NA	1613B	0.000048	0.005	NA
1,2,3,6,7,8,-HxCDD	57653-85-7	NA	NA	NA	NA	1613B	0.000052	0.005	NA
1,2,3,7,8,9,-HxCDD	19408-74-3	NA	NA	NA	NA	1613B	0.000049	0.005	NA
1,2,3,4,6,7,8,-HpCDD	35822-39-4	NA	NA	NA	NA	1613B	0.000061	0.005	0.69
OCDD	3268-87-9	NA	NA	NA	NA	1613B	0.000123	0.01	23
Total tetrachlorinated dioxins	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total pentachlorinated dioxins	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total hexachlorinated dioxins	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total heptachlorinated dioxins	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Furans									
2,3,7,8,-TCDF	51207-31-9	NA	NA	NA	NA	1613B	0.000049	0.001	0.00077
1,2,3,7,8,-PeCDF	57117-41-6	NA	NA	NA	NA	1613B	0.000037	0.005	0.0026
2,3,4,7,8,-PeCDF	57117-31-4	NA	NA	NA	NA	1613B	0.000033	0.005	0.00003
1,2,3,4,7,8,-HxCDF	70648-26-9	NA	NA	NA	NA	1613B	0.000048	0.005	0.0027
1,2,3,6,7,8,-HxCDF	57117-44-9	NA	NA	NA	NA	1613B	0.000056	0.005	0.0027
1,2,3,7,8,9,-HxCDF	72918-21-9	NA	NA	NA	NA	1613B	0.000107	0.005	0.0027
2,3,4,6,7,8,-HxCDF	60851-34-5	NA	NA	NA	NA	1613B	0.000058	0.005	0.0027
1,2,3,4,6,7,8,-HpCDF	67562-39-4	NA	NA	NA	NA	1613B	0.000054	0.005	0.69
1,2,3,4,7,8,9,-HpCDF	55673-89-7	NA	NA	NA	NA	1613B	0.000076	0.005	0.69
OCDF	39001-02-0	NA	NA	NA	NA	1613B	0.000081	0.01	23
Total tetrachlorinated furans	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total pentachlorinated furans	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total hexachlorinated furans	NA	NA	NA	NA	NA	1613B	NA	NA	NA
Total heptachlorinated furans	NA	NA	NA	NA	NA	1613B	NA	NA	NA

Table 11

Reporting Limits and Screening Level Values
Univar Facility, Portland, Oregon

Analyte[a]	CAS Registry Number	Water Analyses: Lab Method	Water Analyses: MDL (ug/L)	Water Analyses: MRL[b] (ug/L)	Water Analyses: SLV (ug/L)	Sediment Analyses: Lab Method	Sediment Analyses: MDL (ug/kg)	Sediment Analyses: MRL[b,c] (ug/kg)	Sediment Analyses: SLV (ug/kg)
TPH Compounds									
Diesel range organics	NA	NWTPH-Dx	11	100	NA	NWTPH-Dx	1,200	25,000	NA
Residual range organics	NA	NWTPH-Dx	11	100	NA	NWTPH-Dx	2,900	100,000	NA
Oil and Grease									
Oil and Grease	NA	1664	1.1	5	NA	NA	NA	NA	NA

Notes:

a) **Highlighted** analytes are chemicals known to be associated with facility operations and/or site remedial activities, or have otherwise been detected in site soil and/or groundwater.

b) The MRL represents the level of the lowest calibration standard (i.e., the practical quantitation limit [PQL])

c) MRLs are highly matrix dependant and will vary with moisture content in the project samples. MRLs are provided for guidance and may not always be achievable.

d) Total chlordane will be calculated from the sum of alpha-chlordane, gamma-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.

NA = Not Applicable
SIM = Selected Ion Monitoring
MDL = Method Detection Limit
MRL = Method Reporting Limit
SLV = Screening Level Value

ug/L = micrograms per liter
ug/kg = micrograms per kilogram
TBD = To Be Determined
TEQ = Toxicity Equivalence Quotient

TCDF = tetrachlorodibenzofuran
PeCDF = pentachlorodibenzofuran
HxCDF = hexachlorodibenzofuran
HpCDF = heptachlorodibenzofuran
OCDF = octachlorodibenzofuran

TCDD = tetrachlorodibenzo-p-dioxin
PeCDD = pentachlorodibenzo-p-dioxin
HxCDD = hexachlorodibenzo-p-dioxin
HpCDD = heptachlorodibenzo-p-dioxin
OCDD = octachlorodibenzo-p-dioxin

Table 12

Field Equipment and Supplies
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Forms/Documentation
Field logbooks
Field sampling data sheets
Chain-of-custody/laboratory analysis report form
Custody seal
Project photo log
Health and Safety Plan (HASP)
Field sampling and analysis plan (SAP)
Large scale site map
Tools
Fiberglass tape with stainless-steel weight
Tape measure calibrated to 0.1 inch
Decon brushes
Flashlight
Manhole and catch basin lid lifting tools
Tool kit
Electric cordless drill
Shovel
Stormwater Sampling Equipment
pH/conductivity meter
pH paper
Thermometers (°C)
Isco 6712 automatic sampler with stainless steel hanger for placement inside a manhole
Protective cover and cones for above ground placement of automatic sampler
Isco 750 AV flow module with stainless steel mounting bracket/hardware
Teflon® intake tubing with strainer and stainless steel mounting bracket/hardware
Glass sample collection containers, Teflon® lined caps, and labels.
Glass compositing containers
12-volt deep cycle battery
Distilled water
Cellular modem for remote operation (if needed)
Sediment Sampling Equipment
Boston style PTFE sediment trap bottles (certified clean) with Teflon® lined caps
Wide mouth PTFE sediment storage bottles (certified clean) with Teflon® lined caps
Stainless-steel mounting brackets and hardware
Stainless-steel mixing bowl
Stainless-steel mixing implements (i.e., spoons, rods, etc.)
2-5 micron filter paper
Stainless steel funnel
Glass flasks and jars
Plastic baggies
Labels
Plastic baggies
Storage refrigerator and freezer unit

Table 12

Field Equipment and Supplies
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Health and Safety Equipment
Fire extinguisher
First aid kits
Safety glasses
Eyewash
Ear plugs
Tyvek®
Gloves – nitrile, vinyl, neoprene
Duct tape
Miscellaneous Equipment
Stainless- steel work surface
Spray paint, pencils, pens, labels
Metal or wooden rod
Waterproof markers
Water jugs and sprayers
Hazardous materials packaging
Bubble wrap and tape for shipping
Cameras and film
Resealable plastic bags
Paper towels
Visqueen sheets
Buckets
Squirt bottle (wash)
Cotton gloves
Nalgene wash bottles
Reagent bottles
Coolers with foam dividers (sample transport and shipping)
Scrub brushes
Plastic tubs
Ice, in leak-proof bags
Drinking water

Table 13

Work Elements and QAPP Coverage Covered by Existing Plans
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

	Covered by Existing DCQAP[a]	Covered by Existing SAP/QAPP[b]	Covered by this Work Plan
Stormwater sampling	NA	NA	Section 8.3
Sediment trap sampling	NA	NA	Section 8.4
Laboratory analysis of stormwater and sediment trap samples	NA	NA	Section 9.2
Decontamination and Disposal	Sections 10.1 and 10.2	Sections 3.7 and 3.8	Section 8.7
Sample Custody Procedures	Section 11.0	Section 3.5	Section 8.6
Data Reduction, Validation, and Reporting	Section 14.0	Section 4.0	Section 9.0

Notes:

a) Data Collection Quality Assurance Plan, Harding Lawson Associates, February 14, 1989 (HLA 1989).

b) Sampling and Analysis Plan and Quality Assurance Project Plan, IT Corporation, July 5, 2001 (ITC 2001).

Table 14

Laboratory and Field Quality Control Sample Summary
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Matrix	QA/QC Analyses	Frequency
Laboratory		
Water	Laboratory control sample (LCS)	Every analytical batch
	MS/MSD	1 per 20 project samples
	Method blank	Every analytical batch
Sediment	Laboratory control sample (LCS)	Every analytical batch
	MS/MSD	1 per 20 project samples
	Method blank	Every analytical batch
Field		
Water	Equipment blank/field rinsate[a]	1 per 20 project sample or 1 per day when non-dedicated sampling equipment is used. Analyze for VOCs and phthalates.
	Trip blank	1 per cooler when samples are analyzed for VOCs
	Field duplicate	1 per 20 project samples
Sediment	Equipment blank/field rinsate	1 per day when non-dedicated sampling equipment is used. Analyze for VOCs and phthalates.
	Trip blank	1 per cooler when samples are analyzed for VOCs
	Field duplicate	Optional (analyzed when addressing specific data concerns)

Notes:

a) Equipment rinsate samples from automatic water samplers will be performed by pumping deionized water through the sampler, into a new/clean sample collection container, and transferred to sample containers for laboratory analysis.

Table 15

QC Acceptable Criteria
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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
Conventional Analyses					
LCS/LCSD	Total organic carbon	90-109	20	85-115	20
	Total suspended solids	85-115	20	NA	NA
	Percent solids	NA	NA	NA	20
	Grain Size	NA	NA	82-110	± 10
MS/MSD	Total organic carbon	65-133	20	75-125	20
Metals and Inorganics					
LCS/LCSD	Aluminum	85-115	30	53-147	30
	Antimony	85-115	30	32-162	30
	Arsenic	85-115	30	80-115	30
	Cadmium	85-115	30	79-127	30
	Chromium (total)	85-115	30	77-127	30
	Copper	85-115	30	80-128	30
	Iron	92-111	30	75-125	30
	Lead	85-115	30	81-129	30
	Manganese	85-115	30	80-120	30
	Mercury	77-123	24	75-118	30
	Molybdenum	66-135	30	73-143	30
	Nickel	85-115	30	83-131	30
	Selenium	85-115	30	84-133	30
	Silver	85-115	30	76-128	30
	Zinc	85-115	30	77-139	30
	Cyanide (total)	90-100	20	NA	NA
	Cyanide (amenable)	85-115	20	NA	NA
	Cyanide (free)	TBD	20	NA	NA
	Sulfides	74-122	30	55-130	30
	Sulfate	90-110	30	90-110	30
	Ammonia (as Nitrogen)	90-112	30	86-115	30
MS/MSD	Aluminum	70-130	30	70-130	30
	Antimony	70-130	30	10-125	30
	Arsenic	70-130	30	61-128	30
	Cadmium	70-130	30	79-127	30
	Chromium (total)	70-130	30	48-151	30
	Copper	70-130	30	44-153	30
	Iron	70-130	30	75-125	30
	Lead	70-130	30	51-155	30
	Manganese	70-130	30	70-130	30
	Mercury	71-125	24	60-123	30
	Molybdenum	70-130	30	53-143	30
	Nickel	70-130	30	80-114	30
	Selenium	70-130	30	84-133	30
	Silver	70-130	30	76-128	30
	Zinc	70-130	30	77-139	30
	Cyanide (total)	90-120	20	NA	NA
	Cyanide (amenable)	75-125	20	NA	NA
	Cyanide (free)	75-125	20	NA	NA

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
	Sulfides	74-122	30	34-166	30
	Sulfate	80-120	30	80-120	30
	Ammonia (as Nitrogen)	90-112	30	42-143	30
Polychlorinated Biphenyl (PCB) Congeners (select list of 35)					
LCS/LCSD	2,4'-DiCB (PCB-8)	42-134	40	47-136	40
	2,2',5-TrCB (PCB-18)	39-123	40	41-121	40
	2,4,4'-TrCB (PCB-28)	52-147	40	50-147	40
	2,2',3,5'-TeCB (PCB-44)	49-130	40	48-130	40
	2,2',5,5'-TeCB (PCB-52)	46-115	40	37-127	40
	2,3,4,4'-TeCB (PCB-60)	48-183	40	42-180	40
	2,3',4,4'-TeCB (PCB-66)	46-124	40	48-122	40
	3,3',4,4'-TCB (PCB-77)	51-133	40	55-132	40
	3,4,4',5-TCB (PCB-81)	48-123	40	37-142	40
	2,2',3,4,5'-PeCB (PCB-87)	46-117	40	41-122	40
	2,2',3,4',5-PeCB (PCB-90)	38-164	40	30-191	40
	2,2',4,5,5'-PeCB (PCB-101)	64-140	40	58-144	40
	2,3,3',4,4'-PeCB (PCB-105)	46-143	40	48-138	40
	2,3,4,4',5-PeCB (PCB-114)	45-131	40	43-126	40
	2,3',4,4',5-PeCB (PCB-118)	54-142	40	51-155	40
	2',3,4,4',5-PeCB (PCB-123)	43-133	40	45-130	40
	3,3',4,4',5-PeCB (PCB-126)	49-136	40	55-134	40
	2,2',3,3',4,4'-HxCB (PCB-128)	43-139	40	34-152	40
	2,2',3,4,4',5'-HxCB (PCB-138)	43-125	40	42-128	40
	2,2',4,4',5,5'-HxCB (PCB-153)	36-140	40	42-135	40
	2,3,3',4,4',5-HxCB (PCB-156)	49-144	40	46-141	40
	2,3,3',4,4',5'-HxCB (PCB-157)	41-141	40	27-166	40
	2,3,3',4,4',6-HxCB (PCB-158)	40-144	40	41-144	40
	2,3,4,4',5,6-HxCB (PCB-166)	70-130	40	70-130	40
	2,3',4,4',5,5'-HxCB (PCB-167)	41-127	40	34-132	40
	3,3',4,4',5,5'-HxCB (PCB-169)	50-151	40	57-147	40
	2,2',3,3',4,4',5-HpCB (PCB-170)	42-141	40	42-141	40
	2,2',3,4,4',5,5'-HpCB (PCB-180)	48-145	40	51-141	40
	2,2',3,4,4',5',6-HpCB (PCB-183)	37-140	40	34-142	40
	2,2',3,4,4',6,6'-HpCB (PCB-184)	47-123	40	46-126	40
	2,2',3,4,5,5',6-HpCB (PCB-187)	48-118	40	25-160	40
	2,3,3',4,4',5,5'-HpCB (PCB-189)	48-136	40	49-136	40
	2,2',3,3',4,4',5,6-OcCB (PCB-195)	45-134	40	48-132	40
	2,2',3,3',4,4',5,5',6-NoCB (PCB-206)	47-130	40	42-137	40
	DeCB (PCB-209)	46-130	40	40-138	40

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		Water		Sediment	
Parameter[a]	Analyte	Accuracy (% R)	Precision (% RPD)	Accuracy (% R)	Precision (% RPD)
MS/MSD	2,4'-DiCB (PCB-8)	28-141	40	26-168	40
	2,2',5-TrCB (PCB-18)	13-147	40	21-149	40
	2,4,4'-TrCB (PCB-28)	41-151	40	36-169	40
	2,2',3,5'-TeCB (PCB-44)	36-137	40	30-153	40
	2,2',5,5'-TeCB (PCB-52)	21-138	40	21-149	40
	2,3,4,4'-TeCB (PCB-60)	70-130	40	34-205	40
	2,3',4,4'-TeCB (PCB-66)	45-121	40	19-157	40
	3,3',4,4'-TCB (PCB-77)	39-136	40	47-147	40
	3,4,4',5-TCB (PCB-81)	70-130	40	28-139	40
	2,2',3,4,5'-PeCB (PCB-87)	30-129	40	10-174	40
	2,2',3,4',5-PeCB (PCB-90)	70-130	40	70-130	40
	2,2',4,5,5'-PeCB (PCB-101)	70-130	40	28-191	40
	2,3,3',4,4'-PeCB (PCB-105)	35-147	40	22-166	40
	2,3,4,4',5-PeCB (PCB-114)	70-130	40	34-132	40
	2,3',4,4',5-PeCB (PCB-118)	38-155	40	27-173	40
	2',3,4,4',5-PeCB (PCB-123)	70-130	40	33-144	40
	3,3',4,4',5-PeCB (PCB-126)	39-135	40	40-155	40
	2,2',3,3',4,4'-HxCB (PCB-128)	37-126	40	22-157	40
	2,2',3,4,4',5'-HxCB (PCB-138)	51-109	40	18-149	40
	2,2',4,4',5,5'-HxCB (PCB-153)	45-124	40	17-162	40
	2,3,3',4,4',5-HxCB (PCB-156)	33-151	40	21-161	40
	2,3,3',4,4',5'-HxCB (PCB-157)	70-130	40	43-142	40
	2,3,3',4,4',6-HxCB (PCB-158)	70-130	40	16-188	40
	2,3,4,4',5,6-HxCB (PCB-166)	70-130	40	70-130	40
	2,3',4,4',5,5'-HxCB (PCB-167)	70-130	40	43-123	40
	3,3',4,4',5,5'-HxCB (PCB-169)	37-151	40	47-153	40
	2,2',3,3',4,4',5-HpCB (PCB-170)	45-131	40	21-167	40
	2,2',3,4,4',5,5'-HpCB (PCB-180)	54-130	40	23-171	40
	2,2',3,4,4',5',6-HpCB (PCB-183)	27-149	40	14-172	40
	2,2',3,4,4',6,6'-HpCB (PCB-184)	28-138	40	29-143	40
	2,2',3,4,5,5',6-HpCB (PCB-187)	51-104	40	17-156	40
	2,3,3',4,4',5,5'-HpCB (PCB-189)	70-130	40	46-133	40
	2,2',3,3',4,4',5,6-OcCB (PCB-195)	28-142	40	22-162	40
	2,2',3,3',4,4',5,5',6-NoCB (PCB-206)	44-128	40	32-147	40
	DeCB (PCB-209)	33-133	40	26-150	40
Surrogates	Tetrachloro-m-xylene	10-93	NA	21-125	NA

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
Chlorinated Herbicides					
LCS/LCSD	Dapalon	TBD	40	17-126	40
	Dicamba	TBD	40	56-119	40
	MCPA	TBD	40	40-125	40
	Dichloroprop	TBD	40	51-117	40
	2,4-D	TBD	40	47-120	40
	2,4,5-TP (Silvex)	TBD	40	56-134	40
	2,4,5-T	TBD	40	57-137	40
	2,4-DB	TBD	40	33-176	40
	Dinoseb	TBD	40	10-131	40
	MCPP	TBD	40	39-122	40
MS/MSD	Dapalon	TBD	40	10-161	40
	Dicamba	TBD	40	30-163	40
	MCPA	TBD	40	10-168	40
	Dichloroprop	TBD	40	15-163	40
	2,4-D	TBD	40	10-186	40
	2,4,5-TP (Silvex)	TBD	40	32-162	40
	2,4,5-T	TBD	40	31-166	40
	2,4-DB	TBD	40	11-192	40
	Dinoseb	TBD	40	10-140	40
	MCPP	TBD	40	10-186	40
Surrogates	2,4-Dichlorophenylacetic Acid	TBD	NA	27-171	NA
Organochlorine Pesticides					
LCS/LCSD	alpha-BHC	43-127	40	45-150	40
	beta-BHC	41-129	40	47-149	40
	gamma-BHC (Lindane)	42-128	40	48-146	40
	delta-BHC	47-141	40	59-162	40
	Heptachlor	34-126	40	47-142	40
	Heptachlor epoxide	45-124	40	48-140	40
	Aldrin	10-125	40	43-141	40
	gamma-Chlordane	48-119	40	42-145	40
	alpha-Chlordane	48-119	40	42-145	40
	Endosulfan alpha-	30-115	40	36-124	40
	Endosulfan beta-	32-123	40	42-130	40
	Endosulfan sulfate	46-120	40	48-143	40
	2,4'-DDE	TBD	40	TBD	40
	4,4'-DDE	36-137	40	51-149	40
	2,4'-DDD	TBD	40	TBD	40
	4,4'-DDD	38-140	40	51-152	40
	2,4'-DDT	TBD	40	TBD	40
	4,4'-DDT	45-146	40	59-151	40
	Dieldrin	50-120	40	50-142	40

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
	Endrin	53-132	40	54-155	40
	Endrin aldehyde	30-114	40	31-139	40
	Endrin ketone	45-127	40	41-158	40
	Methoxychlor	48-140	40	55-153	40
	Toxaphene	37-142	40	37-155	40
	Oxychlordane	TBD	40	TBD	40
	cis -Nonachlor	TBD	40	TBD	40
	trans -Nonachlor	TBD	40	TBD	40
	Hexachlorobenzene	TBD	40	TBD	40
MS/MSD	alpha-BHC	30-126	40	36-145	40
	beta-BHC	28-121	40	38-148	40
	gamma-BHC (Lindane)	30-126	40	33-154	40
	delta-BHC	35-138	40	40-164	40
	Heptachlor	21-127	40	38-145	40
	Heptachlor epoxide	24-132	40	29-150	40
	Aldrin	11-124	40	37-143	40
	gamma-Chlordane	35-121	40	27-149	40
	alpha-Chlordane	25-134	40	33-141	40
	Endosulfan alpha-	23-109	40	18-133	40
	Endosulfan beta-	23-119	40	19-147	40
	Endosulfan sulfate	25-130	40	28-149	40
	2,4'-DDE	TBD	40	TBD	40
	4,4'-DDE	21-139	40	32-156	40
	2,4'-DDD	TBD	40	TBD	40
	4,4'-DDD	22-141	40	26-161	40
	2,4'-DDT	TBD	40	TBD	40
	4,4'-DDT	30-143	40	22-174	40
	Dieldrin	25-134	40	37-146	40
	Endrin	35-137	40	34-161	40
	Endrin aldehyde	10-126	40	11-147	40
	Endrin ketone	38-117	40	36-149	40
	Methoxychlor	38-134	40	37-162	40
	Toxaphene	25-134	40	10-184	40
	Oxychlordane	TBD	40	TBD	40
	cis -Nonachlor	TBD	40	TBD	40
	trans -Nonachlor	TBD	40	TBD	40
	Hexachlorobenzene	TBD	40	TBD	40
Surrogates	Tetrachloro-m -xylene	10-121	NA	25-125	NA
	Decachlorobiphenyl	17-150	NA	22-142	NA

Table 15

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
Volatile Organic Compounds (VOCs)					
LCS/LCSD	1,1-Dichloroethene	80-134	40	80-134	40
	1,2-Dichloropropane	79-118	40	79-118	40
	Benzene	75-126	40	75-126	40
	Chlorobenzene	78-106	40	78-106	40
	Chloroform	78-117	40	78-117	40
	Ethylbenzene	79-111	40	79-111	40
	Trichloroethene	81-119	40	81-119	40
	Toluene	77-115	40	77-115	40
	Vinyl Chloride	58-136	40	58-136	40
MS/MSD	1,1-Dichloroethene	40-148	40	40-148	40
	Benzene	38-132	40	38-132	40
	Chlorobenzene	19-129	40	19-129	40
	Trichloroethene	32-135	40	32-135	40
	Toluene	26-133	40	26-133	40
Surrogates	d4-1,2-Dichloroethane	60-120	NA	60-120	NA
	Toluene-D8	63-116	NA	63-116	NA
	4-Bromofluorobenzene	58-117	NA	58-117	NA
	Dimbromofluoromethane	61-116	NA	61-116	NA
Semivolatile Organic Compounds (SVOCs)					
LCS/LCSD	N-Nitrosodimethylamine	30-115	40	20-100	40
	Bis(2-chloroethyl) Ether	30-125	40	22-98	40
	Phenol	32-117	40	34-101	40
	2-Chlorophenol	32-117	40	30-91	40
	1,3-Dichlorobenzene	10-79	40	10-97	40
	1,4-Dichlorobenzene	10-81	40	10-98	40
	1,2-Dichlorobenzene	15-86	40	10-98	40
	Benzyl Alcohol	33-119	40	30-101	40
	Bis(2-chloroisopropyl) Ether	29-116	40	17-100	40
	2-Methylphenol	29-115	40	10-93	40
	Hexachloroethane	10-76	40	10-99	40
	N-Nitrosodi-n-propylamine	TBD	40	10-103	40
	4-Methylphenol	30-116	40	10-98	40
	Nitrobenzene	34-122	40	22-99	40
	Isophorone	33-121	40	35-91	40
	2-Nitrophenol	33-120	40	30-98	40
	2,4-Dimethylphenol	10-116	40	10-81	40
	Bis(2-chloroethoxy)methane	34-119	40	34-93	40
	2,4-Dichlorophenol	33-120	40	35-91	40
	Benzoic Acid	10-118	40	10-50	40
	1,2,4-Trichlorobenzene	14-88	40	18-96	40
	Naphthalene	49-108	40	23-95	40
	4-Chloroaniline	10-110	40	10-95	40
	Hexachlorobutadiene	10-75	40	14-100	40

Table 15

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
	4-Chloro-3-methylphenol	37-120	40	28-98	40
	2-Methylnaphthalene	40-113	40	30-92	40
	Hexachlorocyclopentadiene	10-54	40	10-81	40
	2,4,6-Trichlorophenol	34-118	40	31-96	40
	2,4,5-Trichlorophenol	36-119	40	38-95	40
	2-Chloronaphthalene	30-108	40	33-95	40
	2-Nitroaniline	35-122	40	40-104	40
	Acenaphthylene	56-113	40	38-99	40
	Dimethyl Phthalate	43-116	40	44-99	40
	2,6-Dinitrotoluene	42-120	40	42-100	40
	Acenaphthene	56-111	40	39-90	40
	3-Nitroaniline	24-115	40	28-100	40
	2,4-Dinitrophenol	10-121	40	14-104	40
	Dibenzofuran	59-114	40	40-91	40
	4-Nitrophenol	33-136	40	42-115	40
	2,4-Dinitrotoluene	43-124	40	43-106	40
	Fluorene	61-114	40	41-94	40
	4-Chlorophenyl Phenyl Ether	36-112	40	41-93	40
	Diethyl Phthalate	42-120	40	46-104	40
	4-Nitroaniline	23-120	40	29-107	40
	4,6-Dinitro-2-methylphenol	24-123	40	30-107	40
	N-Nitrosodiphenylamine	30-115	40	20-100	40
	4-Bromophenyl Phenyl Ether	40-113	40	42-97	40
	Hexachlorobenzene	40-114	40	42-98	40
	Pentachlorophenol	24-123	40	28-100	40
	Phenanthrene	58-116	40	44-97	40
	Anthracene	48-115	40	31-104	40
	Di-n-butyl Phthalate	46-119	40	47-129	40
	Fluoranthene	61-130	40	45-111	40
	Pyrene	56-118	40	46-112	40
	Butyl Benzyl Phthalate	43-121	40	50-119	40
	3,3'-Dichlorobenzidine	10-101	40	10-112	40
	Benz(a)anthracene	55-118	40	45-110	40
	Chrysene	61-119	40	50-108	40
	Bis(2-ethylhexyl) Phthalate	34-136	40	48-127	40
	Di-n-octyl Phthalate	39-123	40	52-126	40
	Benzo(b)fluoranthene	57-124	40	51-111	40
	Benzo(k)fluoranthene	65-121	40	52-109	40
	Benzo(a)pyrene	44-122	40	26-125	40
	Indeno(1,2,3-cd)pyrene	44-132	40	47-119	40
	Dibenz(a,h)anthracene	51-131	40	50-115	40
	Benzo(g,h,i)perylene	55-122	40	43-115	40

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Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
MS/MSD	Phenol	10-145	40	10-120	NA
	2-Chlorophenol	27-118	40	12-105	NA
	1,4-Dichlorobenzene	10-72	40	10-105	NA
	N-Nitrosodi-n-propylamine	TBD	40	10-111	NA
	1,2,4-Trichlorobenzene	15-83	40	10-102	NA
	4-Chloro-3-methylphenol	12-141	40	10-119	NA
	Acenaphthylene	44-126	40	19-113	NA
	4-Nitrophenol	43-140	40	11-143	NA
	2,4-Dinitrotoluene	28-136	40	22-125	NA
	Pentachlorophenol	30-148	40	10-146	NA
	Pyrene	45-131	40	10-146	NA
SVOC Surrogate	2,4,6-Tribromophenol	22-148	NA	16-122	NA
	2-Fluorobiphenyl	26-114	NA	10-105	NA
	2-Fluorophenol	16-122	NA	10-89	NA
	Nitrobenzene-d5	24-131	NA	10-100	NA
	Phenol-d6	25-118	NA	15-103	NA
	Terphenyl-d14	28-144	NA	31-126	NA
Chlorinated Dioxins and Furans					
LCS/LCSD	2,3,7,8,-TCDD	67-158	50	67-158	50
	1,2,3,7,8,-PeCDD	70-142	50	70-142	50
	1,2,3,4,7,8-HxCDD	70-164	50	70-164	50
	1,2,3,6,7,8,-HxCDD	76-134	50	76-134	50
	1,2,3,7,8,9,-HxCDD	64-162	50	64-162	50
	1,2,3,4,6,7,8,-HpCDD	70-140	50	70-140	50
	OCDD	78-144	50	78-144	50
	2,3,7,8,-TCDF	75-158	50	75-158	50
	1,2,3,7,8,-PeCDF	80-134	50	80-134	50
	2,3,4,7,8,-PeCDF	68-160	50	68-160	50
	1,2,3,4,7,8,-HxCDF	72-134	50	72-134	50
	1,2,3,6,7,8,-HxCDF	84-130	50	84-130	50
	1,2,3,7,8,9,-HxCDF	78-130	50	78-130	50
	2,3,4,6,7,8,-HxCDF	70-156	50	70-156	50
	1,2,3,4,6,7,8,-HpCDF	82-132	50	82-132	50
	1,2,3,4,7,8,9,-HpCDF	78-138	50	78-138	50
	OCDF	63-170	50	63-170	50

Table 15

QC Acceptable Criteria
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

Parameter[a]	Analyte	Water Accuracy (% R)	Water Precision (% RPD)	Sediment Accuracy (% R)	Sediment Precision (% RPD)
MS/MSD	2,3,7,8,-TCDD	67-158	50	67-158	50
	1,2,3,7,8,-PeCDD	70-142	50	70-142	50
	1,2,3,4,7,8-HxCDD	70-164	50	70-164	50
	1,2,3,6,7,8,-HxCDD	76-134	50	76-134	50
	1,2,3,7,8,9,-HxCDD	64-162	50	64-162	50
	1,2,3,4,6,7,8,-HpCDD	70-140	50	70-140	50
	OCDD	78-144	50	78-144	50
	2,3,7,8,-TCDF	75-158	50	75-158	50
	1,2,3,7,8,-PeCDF	80-134	50	80-134	50
	2,3,4,7,8,-PeCDF	68-160	50	68-160	50
	1,2,3,4,7,8,-HxCDF	72-134	50	72-134	50
	1,2,3,6,7,8,-HxCDF	84-130	50	84-130	50
	1,2,3,7,8,9,-HxCDF	78-130	50	78-130	50
	2,3,4,6,7,8,-HxCDF	70-156	50	70-156	50
	1,2,3,4,6,7,8,-HpCDF	82-132	50	82-132	50
	1,2,3,4,7,8,9,-HpCDF	78-138	50	78-138	50
	OCDF	63-170	50	63-170	50
TPH Compounds and Oil & Grease					
LCS/LCSD	Diesel range organics	TBD	40	63-133	40
	Residual range organics	TBD	40	69-124	40
Surrogates	4-Bromofluorobenzene	TBD	NA	20-150	NA
	o-Terphenyl	TBD	NA	50-150	NA
	n-triacontane	TBD	NA	50-150	NA
Oil and Grease					
LCS/LCSD	Oil and Grease	78-114	40	NA	NA

Notes:

a) Control limits are updated periodically by the laboratories. Control limits that are in effect at the laboratory at the time of analysis will be used for sample analysis and data validation. These may differ slightly from the control limits shown in this table.

LCS = Laboratory Control Sample
LCSD = Laboratory Control Sample Duplicate
MS = Matrix Spike
MSD = Matrix Spike Duplicate
NA = Not Applicable
TBD = To Be Determined
TCDF = tetrachlorodibenzofuran
PeCDF = pentachlorodibenzofuran
HxCDF = hexachlorodibenzofuran
HpCDF = heptachlorodibenzofuran
OCDF = octachlorodibenzofuran
TCDD = tetrachlorodibenzo-p-dioxin
PeCDD = pentachlorodibenzo-p-dioxin
HxCDD = hexachlorodibenzo-p-dioxin
HpCDD = heptachlorodibenzo-p-dioxin
OCDD = octachlorodibenzo-p-dioxin

Table 16

Laboratory Deliverables
Stormwater Pathway Investigation Work Plan
Univar Facility, Portland, Oregon

The following deliverables will be required from the laboratory:

1) A transmittal letter and case narrative which includes information about receipt of the samples, the analytical results, and any significant problems in any aspect of sample analysis (e.g., deviation from methodologies or quality control).

2) Sample analytical results:
    a) Water results in mg/L or µg/L
    b) Soil results in mg/kg or µg/kg
    c) Method reporting limit for undetected values reported for each analyte on a sample-by-sample basis
    d) Date of sample preparation/extraction
    e) Date of sample analysis

3) Method blank results, including the samples associated with each blank

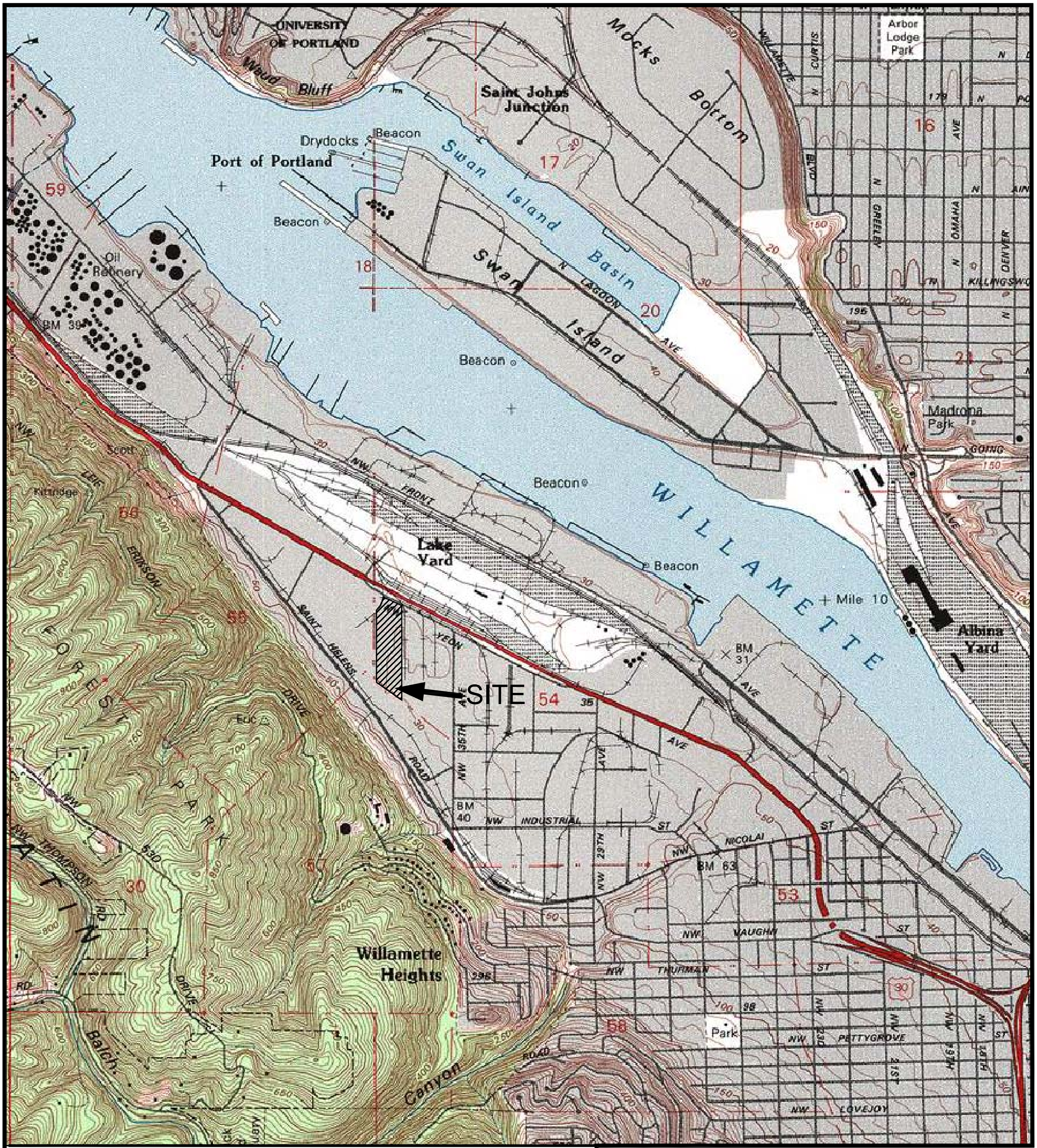
4) Surrogate recovery results, reported as percent recoveries, including actual spike levels

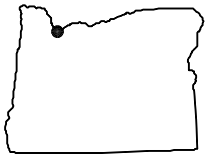
5) Laboratory duplicate results

6) MS/MSD results, reported as percent recoveries, including actual spike levels

7) Copies of signed chain-of-custody forms

FIGURES





N

S C A L E

0 2000 4000 FEET

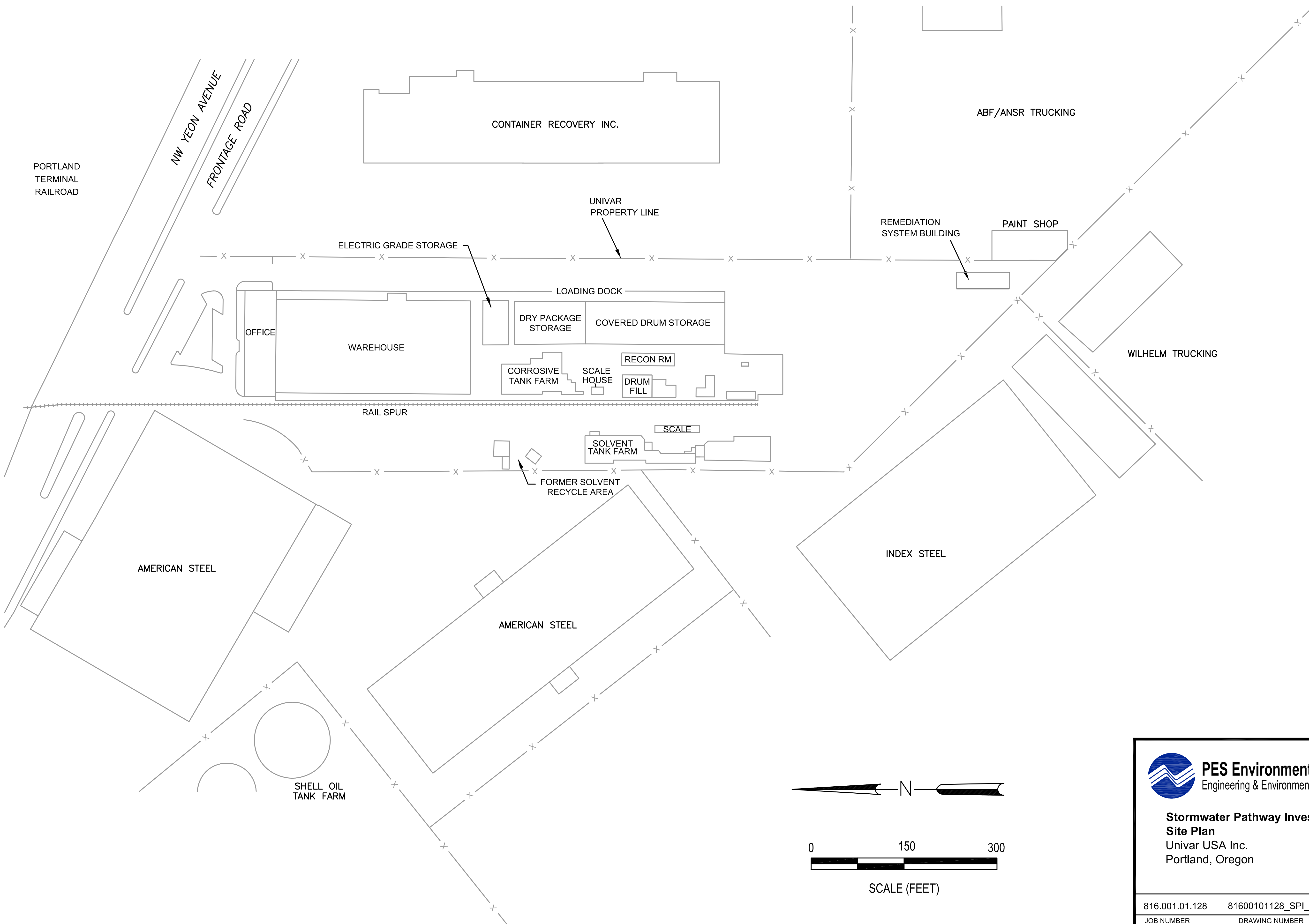
SOURCE:
U.S.G.S. 7.5 Min. Quadrangle, PORTLAND, OR – WA 1961.

PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Pathway Investigation
Site Location Map
Univar USA Inc.
Portland, Oregon

FIGURE
1

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
816.001.01.128	81600101128_SPI_1		4/08

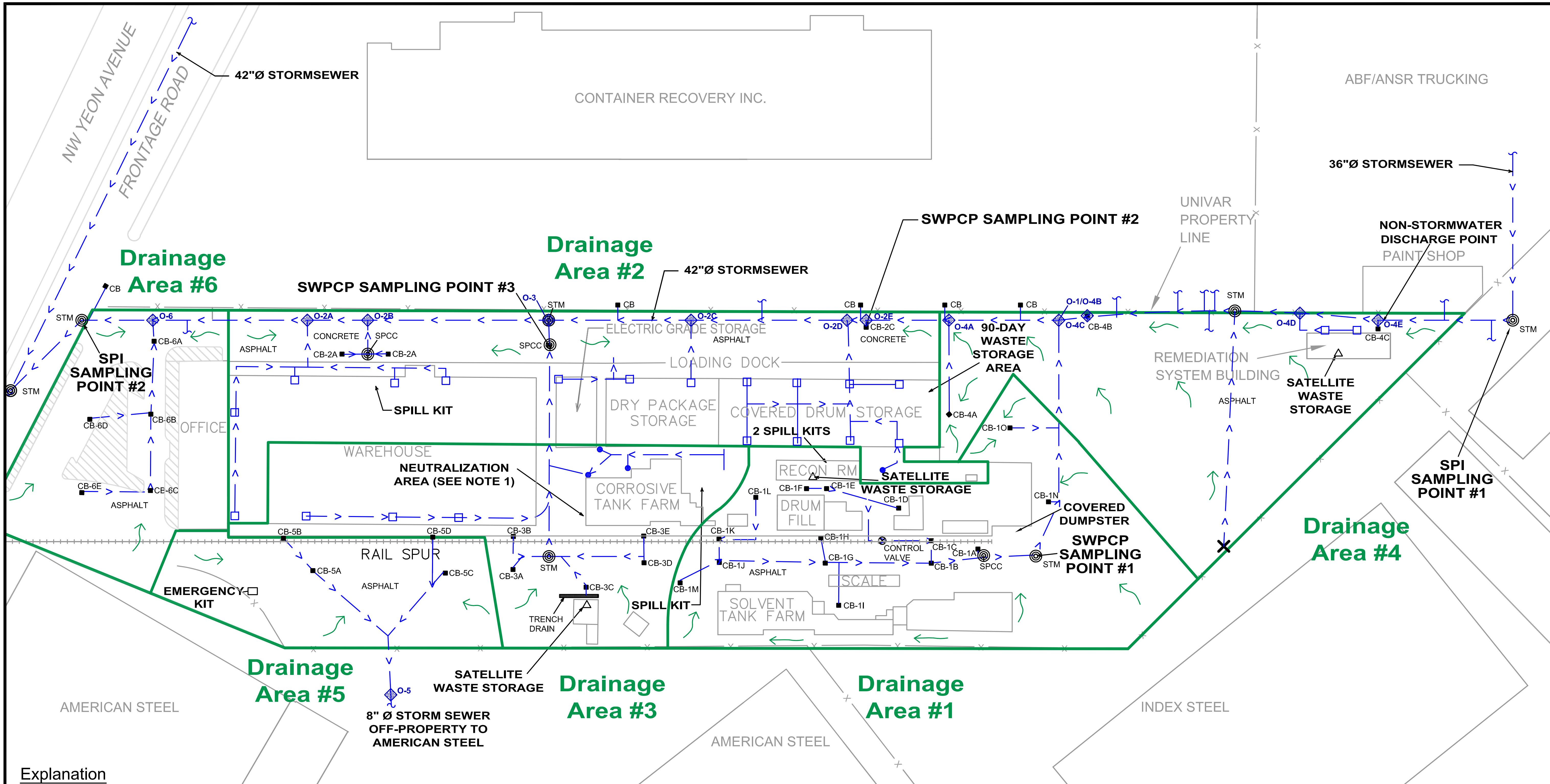


PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Pathway Investigation
Site Plan
Univar USA Inc.
Portland, Oregon

FIGURE
2

816.001.01.128	81600101128_SPI_2		6/08
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE



Explanation

- STORM DRAIN WITH FLOW DIRECTION
- OUTFALL (O-2A)
- CATCH BASIN (CB)
- STORM MANHOLE (STM)
- MANHOLE WITH CONTROL VALVE (SPCC)
- NO SURFACE ACCESS
- FLOOR DRAIN
- ROOF DRAIN
- SATELLITE WASTE STORAGE
- GENERALIZED SURFACE FLOW DIRECTION
- UNPAVED AREA

NOTES:
1) NEUTRALIZATION AREA GRAVITY DRAINS TO SANITARY SEWER

SITE DRAINAGE STRUCTURES

Drainage Area	Outfalls	Catch Basins
1	O-1 / O-4B	CB-1A through CB-1O
2	O-2A through O-2E	CB-2A and CB-2C
3	O-3	CB-3A through CB-3E
4	O-4A through O-4E	CB-4A through CB-4C
5	O-5	CB-5A through CB-5D
6	O-6	CB-6A through CB-6E

N

0 100 200

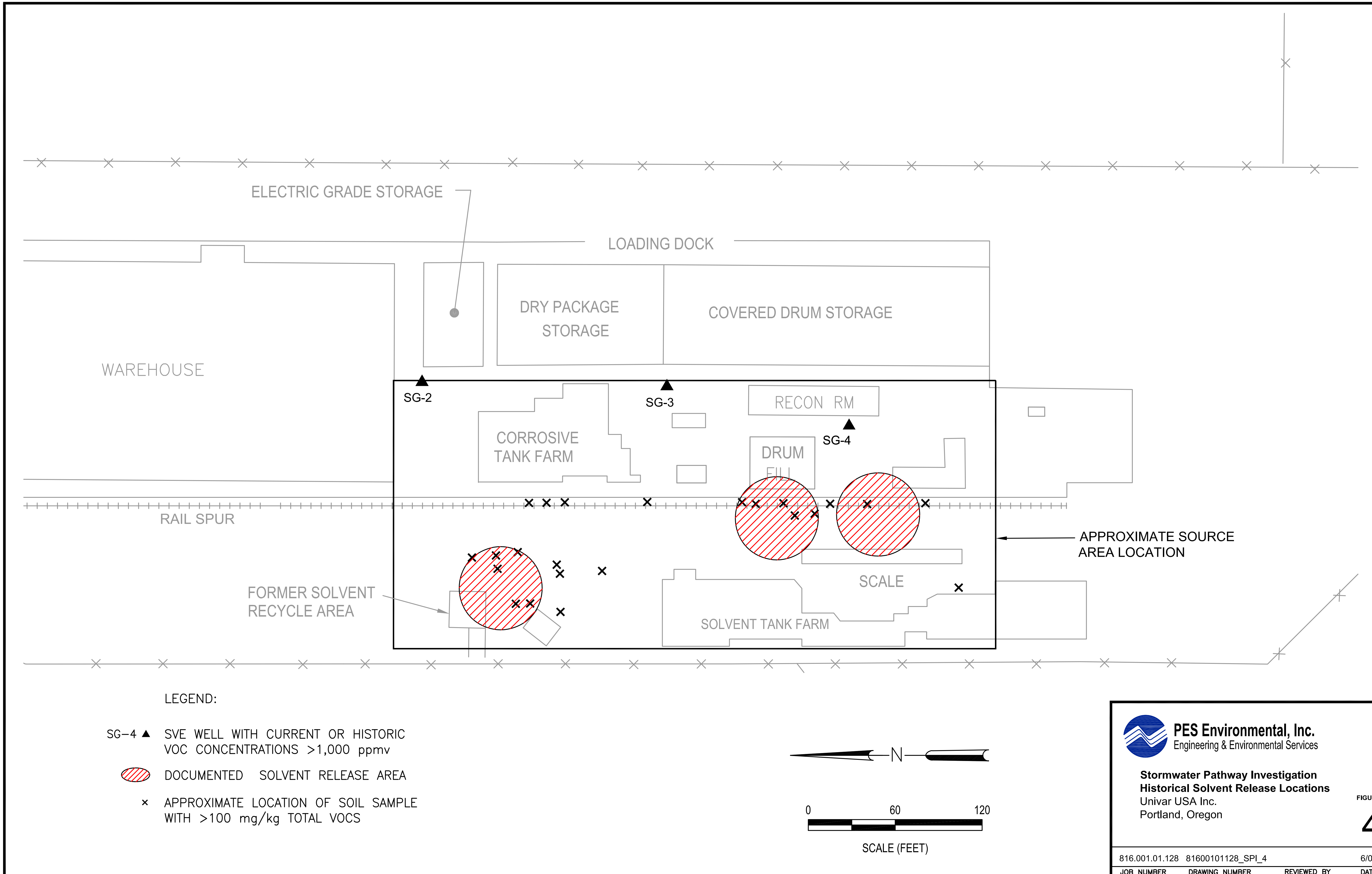
SCALE (FEET)

PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Pathway Investigation
Site Drainage Map
Univar USA Inc.
Portland, Oregon

FIGURE
3

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
816.001.01.128	81600101128_SPI_3		3/10

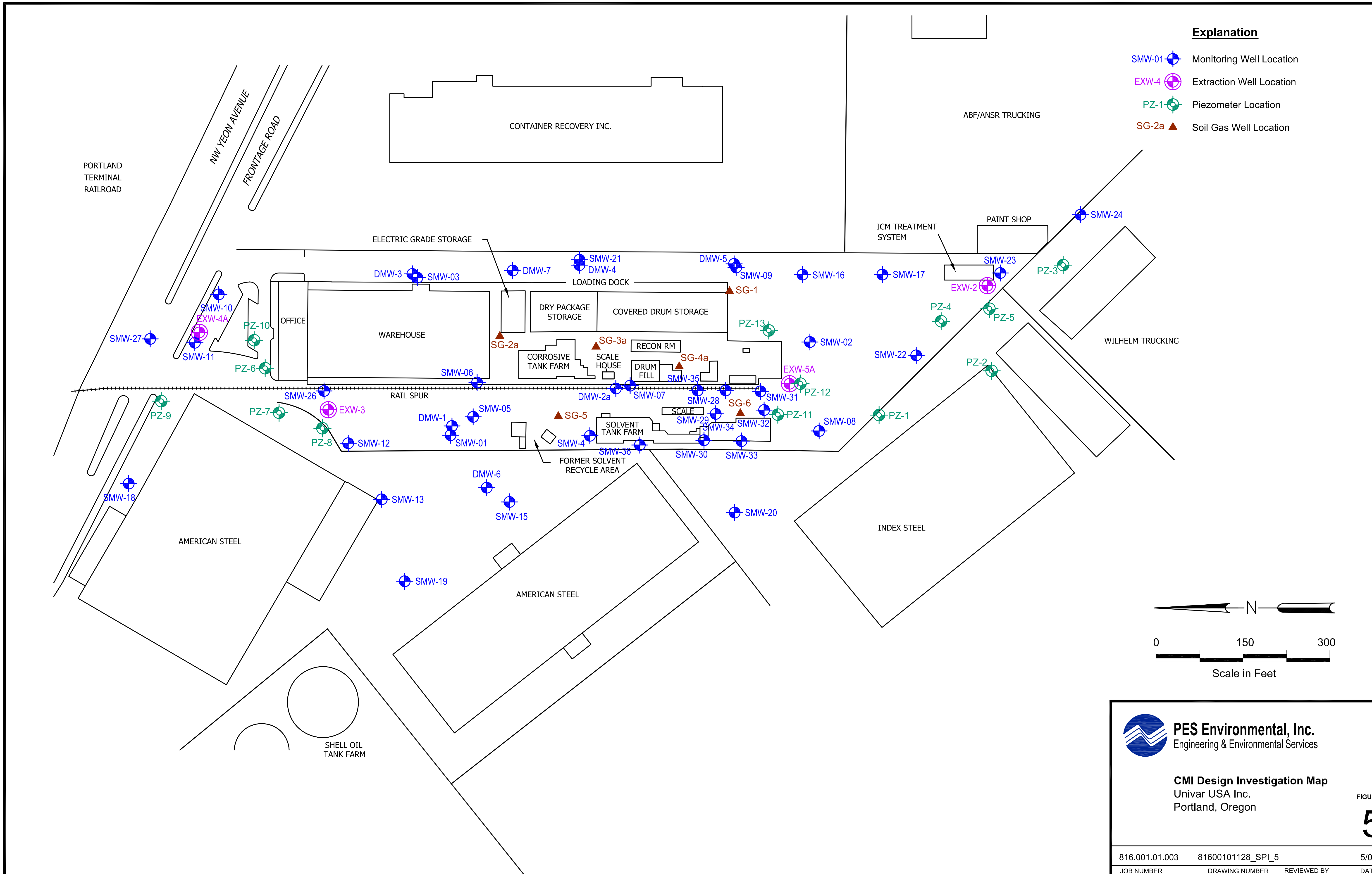


PES Environmental, Inc.
Engineering & Environmental Services

Stormwater Pathway Investigation
Historical Solvent Release Locations
Univar USA Inc.
Portland, Oregon

FIGURE
4

JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE
816.001.01.128	81600101128_SPI_4		6/08



PES Environmental, Inc.
Engineering & Environmental Services

CMI Design Investigation Map
Univar USA Inc.
Portland, Oregon

FIGURE
5

816.001.01.003	81600101128_SPI_5		5/09
JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE

APPENDIX A

City of Portland BES Letter

— CITY OF PORTLAND —
ENVIRONMENTAL SERVICES
1120 SW Fifth Avenue, Room 1000, Portland, Oregon 97204-1912 ▪ Sam Adams, Commissioner ▪ Dean Marriott, Director

September 22, 2006

Mr. Howard Orlean
U.S. Environmental Protection Agency, Region 10
1200 Sixth Avenue, AWT-121
Seattle, WA 98101

Subject: Univar USA, Inc Facility
City of Portland Bureau of Environmental Services Comments on EPA Proposed Final RCRA Corrective Measures Remedy

Dear Mr. Orlean:

The City of Portland Bureau of Environmental Services (BES) is providing comments on the U.S. Environmental Protection Agency's (EPAs) proposed Statement of Basis Proposed Resource Conservation and Recovery Act (RCRA) Remedy Selection for the Univar USA, Inc. (formerly Van Waters & Rogers) facility located at 3950 NW Yeon Avenue, Portland, Oregon. BES appreciates the opportunity to comment and hopes that based on our comments below, EPA will conduct an appropriate investigation of the stormwater pathway prior to finalizing the RCRA remedy for Univar USA, Inc. according to the EPA's and Oregon Department of Environmental Quality's (DEQ's) Joint Source Control Strategy (JSCS) (EPA / DEQ , 2006) for the Portland Harbor Superfund Site and the Memorandum of Understanding between EPA, DEQ and other governmental parties dated February 8, 2001.

As you are aware, the Univar site is located with the Portland Harbor Superfund Site. Specifically, it is located within the City of Portland's stormwater drainage Basin 18 which discharges through Outfall 18 into the Willamette River at approximately River Mile 8.7. Because discharge from the Univar industrial facility drains into the City's stormwater conveyance system, it is critical that this upland facility thoroughly evaluate offsite migration through the site's stormwater pathway(s). This evaluation is necessary to implement the JSCS and to meet the site's corrective action objective to "[p]revent migration of COCs to the Willamette River."

Our review of the RCRA site investigations and corrective action documents, BES correspondence regarding spills and the NPDES permit, Portland Harbor sediment data, and BES inline sampling data collected in this vicinity indicate that the facility's stormwater pathway has not been fully investigated or addressed in the proposed remedy. Our review also found significant evidence of the release and offsite migration through the site's stormwater conveyance systems of hazardous substances handled at the facility. Presented below is information that demonstrates the need for characterization of the stormwater pathway at the facility. We also provide some general suggestions for implementing the JSCS at the Univar site.

Evidence that the Stormwater Pathway may be a Complete Pathway for Contamination to Migrate to the Willamette River

Available information indicates that stormwater from the site is a complete pathway for contamination to reach the Willamette River including the following:

- Univar USA is a chemical storage, packaging, and distribution company that handles a wide variety of chemicals that are hazardous to human health and the environment. There are numerous records of chemical spills documented by the Fire Marshal records and written communications with BES. Some of these documented spills and releases reached the stormwater conveyance system.
- Ninety percent of the site is covered by buildings or paved surfaces suggesting most of the precipitation that enters the site leaves as stormwater which discharges to the City's stormwater conveyance system and to the Willamette River. There are five general stormwater drainage areas on the site, three of which are located in active facility operational areas including:
  - A main stormwater collection area that services the southern portion of the site, which includes half of the rail spur, a drum fill area, solvent tank farm and the groundwater treatment operations,
  - A stormwater collectionarea near the corrosive tank farm and central rail spur, and
  - A stormwater collection area including the southeastern corner of the loading dock and covered drum storage area.
- In 1996, at the request of BES, Univar conducted a solids cleanout from the City's 42-inch stormwater conveyance line east of the facility into which the facility's stormwater drains. The cleanout resulted in the removal of 15-20 cubic yards of sludge with elevated concentrations of VOCs. Based on our review of available information, it appears that the sludge was not analyzed for any of the chemicals stored, packaged or distributed from the facility other than VOCs.
- Analytical data from self monitoring and City monitoring of the wastewater discharge under the BES Industrial Wastewater Discharge permit #400.025 indicates that copper, lead, zinc, chlorinated solvents, and phthalates are present in the facility's waste streams at concentrations above DEQ's and EPA's JSCS screening values. Although these contaminants were detected in discharge water that goes to the sanitary sewer system, it confirms that these contaminants are present at the site and therefore may be present in stormwater discharged from the facility.
- In-river sediment data from near Outfall 18 suggests that within Basin 18 there are sources of the following chemicals: lead, mercury, phthalates, PAHs, PCBs, and DDT metabolites. The Univar facility is located within Basin 18.
- BES conducted in-line solids sampling from within the 42-inch stormwater conveyance line, accessed from manhole AAT557, just down pipe from the Univar facility. The solids sample contained elevated metals (copper, cadmium, chromium, and lead), PCBs, DDTs, chlordane, selected PAHs, and motor oil.

Based upon the information presented above, a wide range of hazardous substances have been released at the Univar facility, and these releases have historically included offsite migration of contaminants through the site's and City's stormwater conveyance systems.

In addition to stormwater runoff from the facility being a potential source of contamination to the Willamette River via the stormwater pathway, there is also evidence that contaminated groundwater from beneath the facility enters the City's 42-inch stormwater conveyance line to the east and north of the facility and migrates to the Willamette via the stormwater pathway. Video surveys of the 42-inch stormwater line in 1996 (Sylvester, 1996) showed staining at some joints and a leaking joint indicating that groundwater enters the line. As a part of the DEQ Cleanup site investigation for Container Recovery (located immediately east of the Univar facility), DEQ requested that Container Recovery investigate whether groundwater from beneath their site enters the 42-inch stormwater conveyance line located between the two sites. The investigation showed that the northern portion of the 42-inch stormwater conveyance line west of Container Recovery (east of Univar) lies below the shallow water table for at least part of the year. There is another 42-inch stormwater conveyance line to the north (downgradient) of the Univar facility that is at a lower elevation than this east 42-inch stormwater conveyance line, suggesting that it is also probable that this line is also below the shallow water table seasonally. Thus, the 1996 video survey coupled with the groundwater versus pipe elevation study conducted for Container Recovery indicates that groundwater from beneath the Univar Facility enters the stormwater pipe and migrates to the Willamette River.

Stormwater Pathway Investigation Suggestions

BES requests that EPA require Univar USA, Inc to conduct an investigation of the stormwater pathway in accordance with the JSCS, including Appendix D. There is already sufficient information on the site history, potential sources, current stormwater controls and NPDES monitoring results. The stormwater pathway investigation should include the following general components:

- Investigate stormwater from the whole facility for a complete suite of constituents including not only those readily identified in Univar's operations but also those found in the solids from the conveyance system, within in-river sediments near Outfall 18, and Harbor-wide pollutants of concern. At a minimum this list includes metals, VOCs, SVOCs, phthalates, PCBs, pesticides, TPH, and total organic carbon. To date, the NPDES permit has only required sampling of a few constituents related to stormwater (copper, lead, zinc, pH, total suspended solids, oil and grease, as specified by the 1200Z general industrial permit) and to the treated groundwater discharge constituents (select VOCs and cyanide). The analyte list required by the NPDES permit lacks many of the constituents identified down pipe from the facility and those stored, packaged, and distributed at the facility.

- Gain a thorough understanding of the site's stormwater system (drainage basins, collections system, lines, discharge points, etc.).

- Sample catch basin solids and screen against JSCS Screening Level Values (SLVs). Catch basin solids should be analyzed for grain size in addition to the constituents listed above. BES "Guidance for Sampling Catch Basin Solids" (JSCS Attachment C of Appendix D) should be followed for sampling. Sampling should be conducted at the beginning of the water year and more times if variability in the catch basin solids is expected. Based on the file review, it appears that no catch basin sampling has been conducted.

- Collect whole water stormwater samples and screen against JSCS SLVs. Sampling should include a minimum of 4 storm events per water year, and sampling locations should represent all stormwater discharges from the facility.
- Plot groundwater elevations relative to the elevation of the stormwater pipes both on the facility and the City's stormwater conveyance pipe around the facility to understand where groundwater could potentially enter the stormwater system. During periods of high shallow groundwater elevations, the stormwater system should be investigated through video or other means for evidence of groundwater entering the stormwater system. If evidence of groundwater entering the system is observed, samples of the water entering the system should be collected and analyzed for the entire suite of constituents listed above.
- The RCRA Corrective Action Remedy will not be complete until it addresses results of the stormwater pathway investigation to prevent migration of contaminants to the Willamette.

BES is concerned that without a complete investigation consistent with the JSCS, the remedy for the site may not address the stormwater pathway at the facility. Because of the location of the site within the Portland Harbor Superfund Study Area and the significant indications of releases to stormwater, it is critical that the stormwater pathway be fully investigated.

We hope we have supplied sufficient information to justify additional investigation of the stormwater pathway prior to selecting the final remedy for the site. Please contact me at 503-823-7263 if you have any questions or need additional information.

Sincerely,

Dawn Sanders
City of Portland Project Manager
Superfund Program

c: Jim Anderson/DEQ
Bruce Gillis/DEQ
Bruce Brody-Heine/GSI

APPENDIX B

Stormwater Sampling Procedure

CORRECTIVE MEASURES IMPLEMENTATION
STORMWATER PATHWAY INVESTIGATION

APPENDIX B – STORMWATER SAMPLING PROCEDURE

The purpose of this procedure is to define and standardize the methods for collecting flow weighted composite stormwater samples using an automatic sampler. The goal of this procedure is to ensure that high quality and representative data are collected. These procedures follow the general techniques and procedures listed in Appendix A (Stormwater Composite Sampling SOP) of the *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling* (Portland Harbor RI/FS; Anchor/Integral 2007).

1.1 General Work Description

Flow-weighted, whole water (unfiltered) sample aliquots will be collected over the course of the storm event with automatic sampling pumps to obtain mean concentrations of each analyte. The whole water samples will be retrieved from the automatic sampling device and transported to the field laboratory or analytical laboratory. Pre-programmed automatic samplers will be deployed at each sampling location for the duration of the storm season. The sampling team will monitor weather and storm forecasts, and will enable the sampling pumps to collect samples during the appropriate storm events. Samples will be retrieved from the sampler using two-person clean sampling techniques. Water collected by the automatic sampling device (i.e., in up to eight separate glass containers) will be composited into a large single glass container. Sample bottles for laboratory analysis will be filled using a peristaltic pump. Samples will be handled and submitted to the analytical laboratory as described in Section 8.0 of the Stormwater Pathway Investigation Work Plan (Work Plan).

1.2 Supplies and Equipment

The general types of equipment required are described in this section. A detailed supply and equipment list is provided in Table 12 of the Work Plan.

An Isco Model 6712 automated sampler unit will be deployed at each sampling location. The sampler will be equipped with glass collection containers, a Teflon® coated intake screen, and a Teflon® sampling tube. Each sampler will be equipped with an area/velocity (AV) type flow meter. Power will be supplied to each sampler using a 50-amp hour GSM deep cycle battery. In addition, stainless steel mounting brackets will be used to mount the flow sensor and sampling tube, and hang the battery and sampler in the catch basin. Samplers may also be equipped with a cellular modem for remote operation.

The sampler intake screen will be mounted close to the bottom of the storm sewer pipe using stainless steel mounting hardware and following manufacturer instructions. Care will be taken to minimize the length of the sampling tubing and ensure that there are no kinks in the tubing.

1.3 Automatic Sampler Deployment

Stormwater samples for standard chemical and conventional analyses will be collected using peristaltic pump through a Teflon®-lined intake tube with a Teflon® coated stainless steel pickup screen, which will feed to a silicon pump tube. The intake tube and screen will be attached to the bottom of the stormwater conveyance pipe along with the Area Velocity (AV) flow sensor. Standard operating procedures for the flow sensor are included the procedures provided in Appendix C of this Work Plan – *Flow Measurement Procedure*.

1.3.1 Sampler Programming

Prior to deployment, the automatic sampler will be programmed to collect flow weighted samples into eight 1.8-liter glass bottles. The sampler will be programmed to collect sample volumes that are proportional to storm flow. Samples will collected on a uniform time basis and the volume collected at each time step will be proportional to the volume of water that has passed the flow meter since the previous time step. The automated sampler collects the stormwater in 10-milliliter (ml) increments. The number of 10-ml increments collected at each time step is dependent on the flow rate and the sampler programming that is unique to each sampling site. The unit volume of stormwater water that passes the flow module per 10-ml sample increment will be estimated for each basin to maximize the likelihood that the minimum volume of water required for analysis is collected without exceeding the total volume capacity of the sampler. A complete sampling event would result in all eight of the 1.8-liter bottles being filled or nearly filled over the duration of the storm such that most of the storm hydrograph is sampled.

Each sampler will be pre-programmed with several sampling routines that include different proportional volume sampling rates so that an appropriate program can be selected based on the magnitude of the storm that is being predicted, the size of the basin, the pipe conditions, etc. For example, for a predicted small storm, a sampler program would be selected that collects relatively large flow proportional volumes at each time interval to achieve the necessary total volumes to perform the necessary analyses. Similarly, for a predicted large storm, a low flow proportional volume for each time interval will be selected. For all sampling conditions, the samplers will be programmed to pre-flush one volume of the intake sample tubing prior to collecting the sample. This will be performed by programming the sampler to fill the tubing, and then reverse the pump to dispel the flush water back into the stormwater conveyance pipe.

The minimum volume collected will be based on the minimum storm expected to generate runoff (0.2 inches). The maximum volume will be based on the forecasted precipitation with some allowance for under-predictions of rainfall associated with a storm.

1.3.2 Sampler Installation and Initialization

Wherever possible, the sampler will be located above ground and next to the location selected for sampling. If the sampler is unable to be located above ground, the sampler and battery case will be installed inside the manhole using stainless steel hardware that is specifically designed for hanging automatic samplers. The mounting specifications in these locations will vary by location, but in each case the sampler will be secured in such a fashion that is stable and will not be inundated by stormwater.

The sample pick up screen and the AV flow sensor will be attached to the sensor carrier mounted to the stainless steel mounting bracket. The mounting bracket is an expandable ring designed for specific pipe diameters. The ring will be bolted to the inside of the stormwater conveyance pipe as needed. Sample tubing and electrical cords will be attached to the side of the pipe and manhole using concrete bolts and plastic ties or similar attachments. Although there are tools that allow surface installation of sensors, confined space entry may be required to install the pickup screen and flow sensor.

After the pickup screen and sensor have been installed, the sampler will be powered up and allowed to go through the self check process. If the sampler check is acceptable, the clean sample containers will be installed. The sampler will then be lowered into the junction, if necessary, or otherwise secured above ground on the site. Care will be taken not to pinch or kink the pick up tube of the flow sensor cable.

Note: If the sampler is outfitted with a cellular modem, the sampler will be manually disabled prior to lowering it into the manhole and then subsequently enabled remotely when it is time to commence sampling. If the sampler is not outfitted with a cellular modem, it will remain disabled until it is time to commence sampling.

The automatic sampler, once enabled, will have been pre-programmed to initiate sampling once specified trigger conditions (e.g., flow depth and/or volume) have been met and will continue to sample until the conditions are no longer met within a 24-hour sampling duration or the bottle capacity is reached. The trigger conditions will be different for each sampling station due to differences in basin sizes, pipe/junction configurations, and runoff characteristics, as well as non-stormwater discharges such as base flow.

1.3.3 Storm Watch Procedures

The sampling team will monitor storm predictions from the NOAA website (http://www.wrh.noaa.gov/forecasts/graphical/sectors/pqrWeek.php#tabs) and area rain gauges. Once the required antecedent conditions are achieved, the team will watch for appropriate storm events and be prepared to enable the automatic sampler. When weather forecasts indicate that a storm may meet the target storm conditions, the weather and rainfall conditions will be monitored on a frequent basis. If a sampler is outfitted with a cellular modem, it may be remotely called to determine if flow conditions at are changing, indicating that local rainfall is starting. Once the appropriate height/volume conditions have been achieved at each location and the storm appears to be likely to meet the target storm conditions, the samplers will be activated to use a specified pre-program consistent with the type of storm occurring as discussed above. The samplers may be polled periodically during the sampling event to understand whether it is likely that the best program is underway for the storm conditions actually occurring and to determine when the sampling routine is likely to be complete.

1.4 Sample Collection Procedures

After the sampling event is completed, the sampler will be disabled. This is especially important if the storm event concludes prior to 24 hours to prevent additional water from being collected. The sample collection containers will be recovered within a goal of 12 hours after the conclusion of the sampling event. The sampling team will retrieve the automatic sampler and remove sample containers, seal them with Teflon® lined caps, label, and package them appropriately for transportation to the sample processing location. The sampling team will install new clean containers and re-deploy the sampler as described below.

Clean handling techniques will be employed as described in Appendix A of the Portland Harbor RI/FS (Anchor/Integral 2007). Two people are needed to conduct the sampling, and a third person is responsible for sample logging and processing, and assisting with lifting the sampler in and out of the catch basin. In addition, the third person may be responsible for recording stormwater parameters.

The clean/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Specific tasks are assigned to the CH and DH, although some tasks may overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless gloves (including phthalate-free vinyl gloves for any locations where phthalates will be sampled) during the entire sampling operation and change gloves frequently, usually with each change in task.

CH takes care of all operations that involve equipment that comes into contact with the sample, and is responsible for the following tasks:

- Preparing clean workspaces for retrieving stormwater collection containers, compositing the collected stormwater, and filling sample bottles for laboratory analysis;
- Handling the stormwater collection containers including capping collection containers with Teflon® lined lids; placing capped containers into coolers for transportation to sample processing location, transferring sample water into the composite container, and filling sample bottles; and

- Inspecting and cleaning the automatic sampler and installing new/clean stormwater collection containers prior to re-deploying the sampler.

DH takes care of all operations that involve contact with potential sources of contamination, and is responsible for the following tasks:

- Working exclusively exterior to the samplers;
- Removing and replacing manhole lids;
- Removing samplers from manholes, if necessary, and releasing catches and lifting off the sampler cover for CH;
- Redeploying sampler including replacing the cover and latches;
- Handling tools, such as hammers, wrenches, keys, and locks;
- Handling the single or multi-parameter instruments for field measurements;
- Setting up and calibrating the field measurement instruments;
- Measuring and recording the water depths and field measurements; and
- Sealing and transporting coolers to sample processing and shipping locations.

1.5 Data Collection and Interpretation

Prior to processing and compositing the samples, it is important to review the flow and sampling data from the automatic sampler data logger. Data can be collected using either a Rapid Transfer Module or a laptop PC (or via cellular modem if installed). The data will also be downloaded prior to disconnecting the power source when batteries must be changed. The data will not be erased from the data logger and will be allowed to overwrite, in case there is a problem downloading the data (the sampler has adequate memory such that there should be capacity to store the entire data record for the sampling period).

As part of the field sampling procedures, the sampling team will download the sampling report and flow data from the data logger to a desk top computer for data analysis using the manufacturer supplied or other compatible software. The data will be reviewed to determine the flow hydrograph and where on that hydrograph samples were taken. The storm data will be compared to the target storm conditions to determine if the samples are representative of the storm, whether the samples meet the sampling criteria, and which of the sample containers will be composited for analyses.

The following criteria will be used to determine the acceptability of stormwater samples:

- Sufficient Sample for Analysis. The samples will be checked to determine if there are adequate sample aliquots and volume for analysis.
- Review Rainfall Data and Criteria. The total rainfall and antecedent dry weather period will be determined to see if the target storm conditions were met using data from the City of Portland and Portland Airport rainfall gauges.
- Review Flow Hydrograph, Sample Collection (time and number), and Storm Criteria. The flow hydrograph and discrete sampling times (relative to storm flow) will be reviewed to determine which sample containers should be composited.

If it appears that samples may not be reasonably representative of the storm or the target storm conditions and the issue cannot be resolved by using one of the contingency measures discussed below, the representativeness of the sample containers selected for compositing will be discussed with EPA. However, it should be noted that laboratory holding times will be in effect and decisions must be made in a timely manner.

1.6 Sample Processing and Compositing Procedures

The stormwater collection containers will be transported in a cooler (with foam dividers) with wet ice to the sample processing location. The collection containers will be stored on ice or in a refrigeration unit until the sampling report and flow data can be reviewed with the goal to composite and preserve samples within 24 hours of collection. The refrigeration unit will be monitored daily to ensure temperature compliance and include a log form to record date, time, and temperature.

It is possible that not all the sample containers will be filled or that the container volume will be exceeded due to differences between the forecasted precipitation and the actual precipitation at the site. As described above, the flow data collected at the time of sample collection will be examined to determine if the sample appears to be valid or needs special compositing considerations before compositing and shipment to the analytical lab.

If the sampling report and flow data indicate that there was no malfunction and all the sample bottles are intact, the compositing and sample preparation will continue. CH will prepare a clean workspace for sample processing. Separate new/clean mixing containers will be used for each sampling location. The composited stormwater will be gently mixed with a decontaminated steel mixing spoon. Composited water will be transferred to analytical sample bottles using a peristaltic pump fitted with new Teflon® intake/discharge tubing and new silicone pump tubing. Samples will be handled and submitted to the analytical laboratory as described in Section 8.0 of the Work Plan.

1.6.1 Sample Compositing and Processing Contingencies

It is possible that problems could occur that may affect the viability of a sample collected. Common potential problems and their contingencies include the following

1. Sample volume is not adequate to conduct all of desired analyses. This may occur when the actual site precipitation is substantially less than the forecasted precipitation. Under these sampling conditions, the sample will be composited as normal and samples for analyses will be prepared in the priority shown in Table 10.

2. Sample volume exceeds sample collection bottle capacity. This may occur when the actual storm intensity is substantially greater than forecasted precipitation. In this case the flow data will be evaluated; if the collected volume represents 50 percent or greater of the total storm and encompasses some of the falling limb of the storm, the total volume will be composited and analyzed per normal procedure. If the sample volume represents less than 50 percent of the total storm volume, the water will be composited, preserved, and held under the conditions shown in Table 10 for possible later analyses in the event that no further storm events can be successfully sampled.

3. A portion of the sample is lost. This would occur when one or more of the sampling bottles were damaged or the sampler malfunctioned. In this situation, the sampling report and flow data will be reviewed to determine what representative portion of the storm volume is missing. It may be possible that a significant portion of the storm was not sampled, and/or there is not adequate volume to complete the desired analyses. Following the process of the two previous scenarios, if the sample includes sample that represents 50 percent of the storm and both rising and falling limb conditions are included, then the sample will be used. If not, the sample will be composited, preserved, and held under the conditions shown in Table 10 for possible later analyses in the event that no further storm events can be successfully sampled.

1.7 <u>Equipment Decontamination</u>

Sampling equipment will be decontaminated prior to deployment, and prior to collecting field quality control equipment rinsate blank samples.

Mounting equipment such as slip rings, nuts and bolts, brackets will be cleaned with a brush, warm soapy water (i.e., non-phosphatic detergent such as Liquinox), and rinsed with tap water.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use power actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris. After the brackets have been installed, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before the intake screen is mounted.

1.7.1 Automatic Sampler

The automatic sampler will be cleaned prior to each sampling event. The sampler cover, center section, retaining ring, and tub of the sampler will be cleaned with a brush, warm soapy water (i.e., non-phosphatic detergent such as Liquinox), and rinsed with tap water. The two pump drain holes will be checked to ensure that they are open and free of debris or buildup.

Sample collection and compositing containers will be washed with warm soapy water (i.e., non-phosphatic detergent such as Liquinox), rinsed with tap water, final rinsed with distilled water, and allowed to dry.

1.7.2 Intake Tubing and Screen

New and clean pump intake screens and tubing will be installed at the beginning of the sampling season. New and clean silicon pump tubing will be installed prior to each sampling event. Prior to deploying the sampling equipment, new tubing will be rinsed by pumping approximately one liter of laboratory supplied deionized water through the tubing. It is not anticipated that the screens and intake tubing will be removed for cleaning between sampling events. The sampler will be programmed to purge the intake tube before and after each stormwater sample is collected, which should ensure that any contamination from previous events is removed or sufficiently diluted to be unimportant. If upon routine inspection, it is observed that algae is growing in the intake tube, debris is blocking the tube, or any other gross contamination issues may exist, contaminated screens and intake tubes will be replaced, or in the case of the screens may be cleaned with a brush, warm soapy water, and tap water rinse.

1.7.3 Mounting Equipment

Sampler mounting equipment and brackets will be washed with a brush, warm soapy water (i.e., non-phosphatic detergent such as Liquinox), and rinsed with tap water after installation and prior to mounting sampling hardware.

1.7.4 Sample Transportation

Coolers for transporting sample collection vessels will be washed with warm soapy water (i.e., non-phosphatic detergent such as Liquinox) and rinsed with tap water.

1.7.5 Phthalate Considerations

For locations where phthalates will be sampled, equipment will be handled with powder and phthalate-free vinyl gloves and will not be placed on any plastic or rubber surfaces (decontaminated stainless steel surfaces are preferred).

1.8 Equipment Maintenance

The samplers will remain in the field for the duration of the deployment period. The Isco samplers will be routinely inspected throughout the course of the deployment period on a frequency dictated by the need for battery replacement. Upon each inspection the proper functioning of Isco samplers will be confirmed by visually inspecting the equipment both inside and outside of the manhole/pipe.

The proper attachment and placement of the flow sensor and intake tube will be verified and any debris will be cleared from this equipment. Tubes will be inspected for bending or occlusions and cleared as necessary. The sampler battery will be replaced as necessary and the proper power up and re-initialization of the sampler will be confirmed prior to leaving the site. The flow sensor will be calibrated as necessary. The flow log memory capacity will be checked and data will be downloaded to a lap top if the memory is near full. If a cellular modem is installed, the sampler will be called to make sure the cell phone connection is properly working.

If the automatic samplers are damaged beyond field repair capability, they will be removed and replaced as quickly as possible. Due to the high cost of automatic sampling equipment, spare samplers will not be maintained and it could be several weeks before new sampling equipment can be procured and deployed.

1.9 References

Anchor Environmental, LLC and Integral Consulting Inc (Anchor/Integral). 2007. *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling*. Prepared for the Lower Willamette Group. March 1.

APPENDIX C

Flow Measurement Procedure

CORRECTIVE MEASURES IMPLEMENTATION
STORMWATER PATHWAY INVESTIGATION

APPENDIX C – FLOW MEASUREMENT PROCEDURE

The purpose of this procedure is to define and standardize the methods for installing and operating area/velocity flow modules for measuring storm water flow during the sampling season. The goal of this procedure is to ensure that high quality and representative data are collected. These procedures follow the general techniques and procedures listed in Appendix D (Flow Meter Measurements) of the *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling* (Portland Harbor RI/FS; Anchor/Integral 2007).

1.1 General Work Description

Flow will be measured with the Teledyne/Isco 750 AV Module (module). The module is an add-on enhancement to the Teledyne/Isco's 6700 Series Samplers that are being used to collect stormwater samples (see Appendix B of this Work Plan). The module provides the ability to collect flow proportional sample volumes or flow-paced samples. The sampler displays the real-time level, velocity, flow rate, and total flow provided by the module. The sampler records this data for later analysis.

The module is designed to measure flow in open channels without a primary device. Area velocity flow conversion requires three measurements: water level, velocity, and pipe dimensions. The AV sensor provides the level and velocity measurements. The pipe dimensions will be measured in the field and entered during module programming so that the pipe cross-section area may be calculated. The flow calculation is made in two steps: 1) the module calculates the pipe cross-section (or area) using the programmed pipe dimensions and the level measurement, and 2) the module multiplies the channel cross-sectional area and the velocity measurement to calculate the flow rate.

The autosampler will be programmed to use the customary U.S. units, such as feet (depth), cubic feet per second or gallons per minute (flow), and gallons or millions of gallons (volume). The sampler will be programmed to record flow data at 5-minute intervals. These data will be periodically downloaded throughout the course of the sampler deployment (as determined by data storage capacity) and entered into the project database.

1.2 Supplies and Equipment

The equipment includes a flow meter module (which attaches to the autosampler), a velocity and level sensor, and a bracket to attach the sensor to the storm sewer pipe.

1.3 Equipment Preparation

Mounting equipment such as slip rings, nuts and bolts, brackets will be cleaned with a brush, warm soapy water (i.e., non-phosphatic detergent such as Liquinox), and rinsed with tap water.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use power actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris. After the brackets have been installed, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before the AV sensor is mounted.

The sensor carrier bracket will be installed into the outlet pipe with an expandable ring so that the sensor will be located at the bottom of the pipe. The diameter of the pipe will be measured and noted for programming the autosampler. The flow meter sensor will be connected to the carrier and the cable will secured so that when the sampler is installed in the catch basin, the cable does not become kinked. The sampler will be turned on and allowed to self check. The installer will enter the programming mode and enter the diameter of the pipe. The installer will measure the depth of water in the pipe and adjust the sampler offset to match the measured value.

1.4 Data Collection

Prior to processing and compositing the samples, it is important to review the flow and sampling data from the automatic sampler data logger. Data can be collected using either a Rapid Transfer Module or a laptop PC (or via cellular modem if installed). The data will also be downloaded prior to disconnecting the power source when batteries must be changed. The data will not be erased from the data logger and will be allowed to overwrite, in case there is a problem downloading the data (the sampler has adequate memory such that there should be capacity to store the entire data record for the sampling period).

As part of the field sampling procedures, the sampling team will download the sampling report and flow data from the data logger to a desk top computer for data analysis using the manufacturer supplied or other compatible software. The data will be reviewed to determine the flow hydrograph and where on that hydrograph samples were taken. The storm data will be compared to the target storm conditions to determine if the samples are representative of the storm, whether the samples meet the sampling criteria, and which of the sample containers will be composited for analyses.

1.5 References

Anchor Environmental, LLC and Integral Consulting Inc (Anchor/Integral). 2007. *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling*. Prepared for the Lower Willamette Group. March 1.

APPENDIX D

Sediment Sampling Procedure

CORRECTIVE MEASURES IMPLEMENTATION
STORMWATER PATHWAY INVESTIGATION

APPENDIX D – SEDIMENT SAMPLING PROCEDURE

The purpose of this procedure is to define and standardize the methods for collecting sediment samples from a stormwater conveyance line using a sediment trap. The goal of this procedure is to ensure that high quality and representative data are collected. These procedures follow the general techniques and procedures listed in Appendix C-1 (Sediment Trap Sampling SOP) of the *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling* (Portland Harbor RI/FS; Anchor/Integral 2007).

1.1 General Work Description

Sediment traps will be deployed at each location for a minimum target period of 3 months. Sediment traps will be inspected at a minimum on a monthly basis. When inspected, if the collection bottle is half full, sediments will be collected and archived and a clean bottle will be returned to the trap. This process will be repeated, and sampled sediments stored frozen for later compositing until the trap deployment period ends. Sediment sample and storage bottles will be capped with Teflon® lined lids, labeled, and sealed.

Once the deployment period has ended, all sampled sediments will be thawed, combined in one decontaminated stainless-steel bowl using decontaminated stainless-steel implements, thoroughly homogenized, and distributed to sample containers for chemical analysis. Samples will be handled and submitted to the analytical laboratory as described in Section 8.0 of the Stormwater Pathway Investigation Work Plan (Work Plan).

1.2 Supplies and Equipment

The general types of equipment required are described in this section. A detailed supply and equipment list is provided in Table 12 of the Work Plan.

One or more 0.5 to 1-liter Boston style high density polyethylene (HDPE) sample bottles with Teflon® lined lids will be deployed at each sampling location. The number and volume of sample bottles will be determined in the field based on the sampling location and anticipated height of stormwater flow. The sediment sample bottle will be affixed in a stainless-steel bracket that is mounted to the bottom of the stormwater conveyance pipe. Sampling locations are expected to require the use of sand bags or structural modifications to generate flow conditions conducive to sediment trap sampling.

1.3 Sample Collection Procedures

Clean handling techniques will be employed as described in Appendix C-1 of the Portland Harbor RI/FS (Anchor/Integral 2007). Two people are needed to conduct the sampling.

The clean/dirty hands technique requires two or more people working together. At the field site, one person is designated as "clean hands" (CH) and a second person as "dirty hands" (DH). Specific tasks are assigned to the CH and DH, although some tasks may overlap and can be handled by either as long as contamination is not introduced into the samples. Both CH and DH wear appropriate non-contaminating, disposable, powderless gloves (including phthalate-free vinyl gloves for any locations where phthalates will be sampled) during the entire sampling operation and change gloves frequently, usually with each change in task.

CH takes care of all operations that involve equipment that comes into contact with the sample, and is responsible for the following tasks:

- Preparing clean workspaces for retrieving sediment sample bottles;
- Retrieving filled sample bottles, deploying clean/new sample bottles, and capping sample bottles with Teflon® lined lids; and
- Compositing samples at the end of the sampling season and filling sample jars for laboratory analysis.

CH will use double glove techniques to deploy and retrieve sample bottles. CH will deploy new/clean sample bottles by entering the manhole, removing the outer layer of gloves, receiving a new/clean sample bottle from DH, placing the sample bottle into the bracket, and removing the cap. When a sample bottle is at least half full CH will retrieve the sample bottle by entering the manhole, removing the outer layer of gloves, capping the sediment sample bottle with a Teflon® lined lid, and passing the sediment sample to DH (who will pack it into a cooler for transport). CH will remain in the manhole and deploy new/clean sample bottles as described above.

DH takes care of all operations that involve contact with potential sources of contamination, and is responsible for the following tasks:

- Removing and replacing manhole lids;
- Preparing and deploying sediment sample bottle brackets, mounting hardware, and sandbags etc. (if necessary);
- Handling only capped sediment sample bottles (both new/clean and filled);
- Placing capped bottles into coolers for transportation to sample storage/processing location;

- Handling tools, such as hammers, wrenches, keys, and locks;
- Measuring and recording the water depths and field measurements; and
- Sealing and transporting coolers to sample processing locations.

1.4 Sample Processing Procedures

The sediment sample bottles will be transported in a cooler (with foam dividers) with wet ice to the sample processing location. Processed samples will be stored in a storage freezer unit that will be monitored daily to ensure temperature compliance. The storage freezer will have a log form to record date, time, and temperature.

At sample processing location, the samples will be removed from the sediment trap bottles and transferred to wide-mouth jars for storage in the freezer until the end of the sampling period. Since the Boston style sediment trap bottles are susceptible to breakage when frozen, the samples will be transferred to wide mouthed HDPE storage jars which are less likely to break when frozen. Due to risk of potential contamination, care must be taken when transferring sediment from the sample bottle to the storage jar.

Sediment removal will require several iterations to recover sediment material from the ½-inch diameter sample bottles. Sediment removal will be performed by CH using the following procedure.

1. Decant most of the water from each sample bottle into a decontaminated flask;
2. Swirl or stir the remaining water in the sample bottle with a decontaminated stainless-steel implement to mobilize the sediments;
3. Pour the slurry into 2-5 micron filter paper that is fitted into a decontaminated stainless-steel funnel and allow the leachate to drain into a second decontaminated flask;
4. Once the sediment has drained, lift out the sample by the filter paper, and transfer the sediment into the wide mouthed HDPE sample storage jar. If necessary, sediment may be first transferred to a decontaminated stainless-steel mixing bowl prior to adding to the sample storage jar;
5. Using the liquid collected in the flasks, rinse the sample bottle to mobilize the rest of the sediment and pour in the filter paper;
6. Scrape the sediment from the filter paper and add to the wide mouthed HDPE sample storage jar;

7. Cap the sediment storage jar with a Teflon® lined lid, affix label to the jar (noting sample location, deployment dates, and recovery date), insert the sealed jar into a double layer of plastic bags, and place the jar into the freezer for storage until the end of the sampling season.

Once the sediment trap deployment period has ended, all sampled sediments (including archived aliquots, which have been allowed to thaw in the refrigerator) will be combined in one decontaminated stainless-steel bowl using decontaminated stainless-steel implements and thoroughly homogenized and distributed to sample jars for laboratory analysis.

Sample analysis containers will be filled in the priority order shown in Table 10 of the Work Plan, until the bowl is empty. Samples will be handled and submitted to the analytical laboratory as described in Section 8.0 of the Work Plan.

1.5 Equipment Decontamination

Sampling equipment will be decontaminated prior to deployment or will be new certified clean.

1.5.1 Sediment Traps

The sediment trap mounting hardware will be constructed of stainless steel. Prior to installation, it will be cleaned with a brush, warm soapy water (i.e., non-phosphatic detergent such as Liquinox), and rinsed with tap water. The Boston style HDPE sample bottles will be provided certified clean and certified phthalate free from the analytical laboratory.

When installing the brackets in the field at the sampling sites, it may be necessary to drill holes or use power actuated tools to set studs, weld, or use other means to attach the sampling hardware that may create some debris. After the studs are set or other procedures are complete, the work site will be scrubbed with a brush to remove any debris and rinsed with deionized water before the stainless steel sampling hardware (sample bottle holder) is mounted.

1.5.2 Sediment Sample Processing Equipment

Equipment that is used to extract sediment from trap bottles, transfer samples to storage jars, homogenize samples, and distribute sediment to sample containers for laboratory analysis will be washed with warm soapy water (i.e., non-phosphatic detergent such as Liquinox), rinsed with tap water, final rinsed with distilled water, and allowed to dry. This equipment includes glass flasks, stainless steel implements (e.g., spoons, rods, etc.), stainless steel funnel, and stainless steel mixing bowls. The wide mouth HDPE sample storage jars will be provided certified clean and certified phthalate free from the analytical laboratory.

1.5.3 Sample Transportation

Coolers for transporting sealed sediment trap bottles will be washed with warm soapy water (i.e., non-phosphatic detergent such as Liquinox) and rinsed with tap water.

1.5.4 Phthalate Considerations

For locations where phthalates will be sampled, equipment will be handled with powder and phthalate-free vinyl gloves and will not be placed on any plastic or rubber surfaces (decontaminated stainless steel surfaces are preferred).

1.6 Equipment Maintenance

The sediment will remain in the field for the duration of the deployment period. The sediment traps will be routinely inspected throughout the course of the deployment period on a monthly minimum frequency or as dictated by the need for battery replacement in the automated stormwater sampling equipment (installed in the same manhole). Upon each inspection the proper functioning of sediment traps will be confirmed through visual inspection.

Sediment traps will be inspected to determine that the trap is still properly attached to the junction or pipe and that the bottles are properly seated within the sampler. Any debris will be cleared away from around the samplers.

If the sediment traps are damaged beyond field repair capability, they will be removed and replaced as quickly as possible with spare equipment.

1.7 References

Anchor Environmental, LLC and Integral Consulting Inc (Anchor/Integral). 2007. *Portland Harbor RI/FS, Round 3A Field Sampling Plan, Stormwater Sampling*. Prepared for the Lower Willamette Group. March 1.

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MARCH 29, 2010

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